DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-297

TO 16-30VRC19-5

RADIO SETS AN/VRC-19 -19X, AND -19Y

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

AUGUST 1954

WARNING

HIGH VOLTAGE

is used in the operation
of this equipment

DEATH ON CONTACT

may result if personnel fail
to observe safety precautions

Be careful not to contact high-voltage connections or input connections when working on or near this equipment. When working inside the equipment, after the power has been turned off, always short-circuit the high-voltage capacitors.

Technical Manual
No. 11-297
Technical Order
No. 16-30VRC19-5

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
Washington 25, D. C., *25 August 1954*

RADIO SETS AN/VRC-19, -19X, AND -19Y

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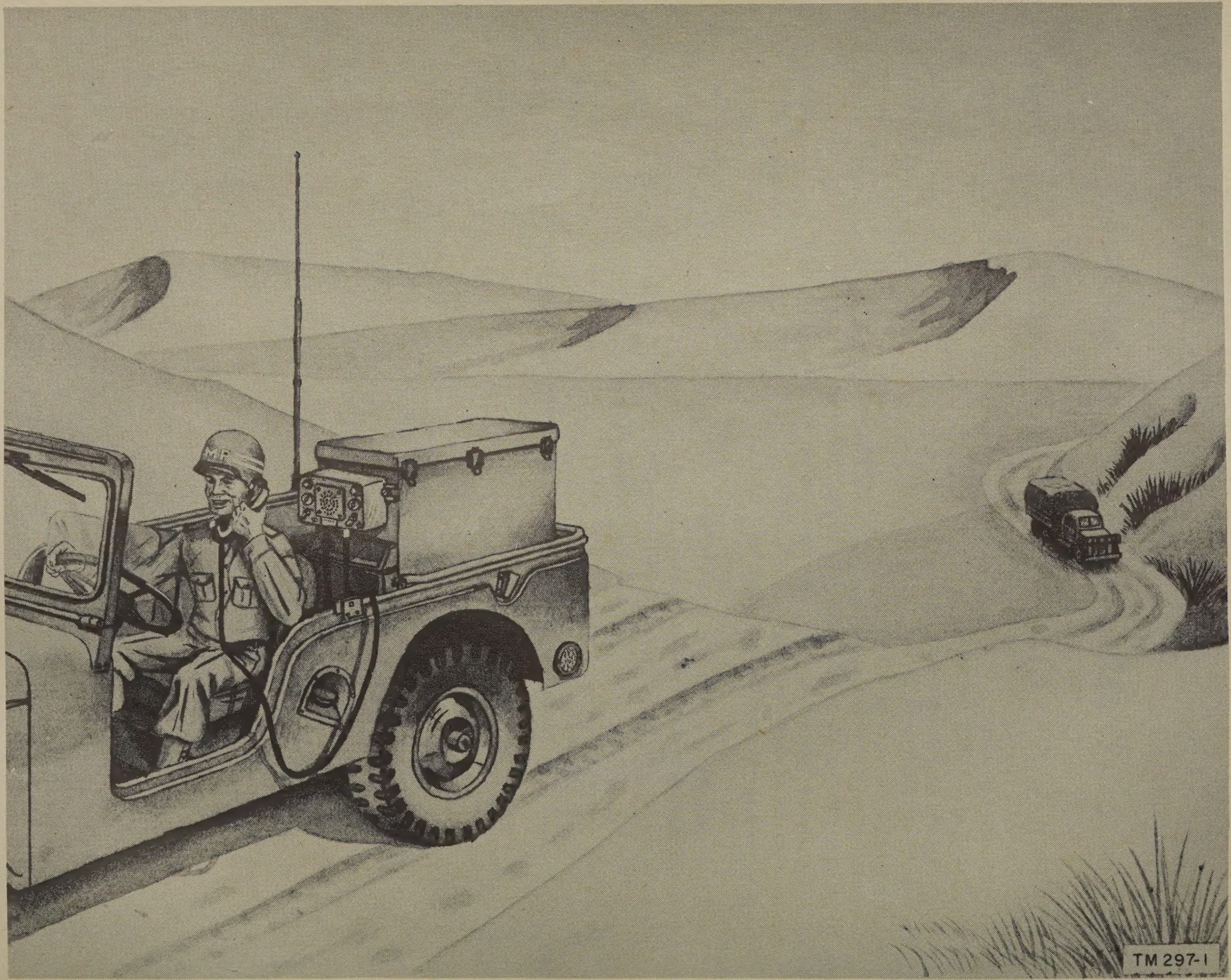


Figure 1. Radio set AN/VRC–19(*) in use.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This technical manual contains instructions for the installation, operation, maintenance, and repair of Radio Set AN/VRC–19(*) (fig. 1). Official nomenclature followed by (*) is used to indicate all models of the equipment covered in this technical manual. Thus, Radio Set AN/VRC–19(*) represents Radio Set AN/VRC–19 (24 volts), Radio Set AN/VRC–19X (12 volts), and Radio Set AN/VRC–19Y (6 volts); Electrical Equipment Cabinet CY–938(*)/VRC represents Electrical Equipment Cabinet CY–938/VRC and Electrical Equipment Cabinet CY–938A/VRC.

b. A list of nomenclature assignments for the components of the radio set is given below. A common usage name is indicated after each component.

Nomenclature	*Common Usage*
Dynamotor-Power Supply DY–100/U, DY–93/G, or DY–98/G.	Transmitter power supply.
Electrical Equipment Cabinet CY–938(*)/VRC.	Equipment cabinet.
Electrical Equipment Rack MT–1236/VRC.	Mounting rack.
Electrical Special Purpose Cable Assembly CX–2341/U.	Control cable.
Electrical Special Purpose Cable Assembly CX–2342/U or Electrical Power Cable Assembly CX–2343/U.	Battery cable.
Power Supply PP–867/U, PP–868/U, or PP–869/U.	Receiver power supply.
Radio Receiver R–394/U	Receiver.
Radio Set AN/VRC–19(*)	Radio set.
Radio Set Control C–847/U	Control unit.
Radio Transmitter T–278/U	Transmitter.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), Navy Shipping Guide, Article 1850–4, and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 27).

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Radio Set AN/VRC–19(*) (fig. 1) is a mobile frequency-modulated (fm) set normally used for nontactical purposes. It operates in the frequency range of 152 to 174 megacycles (mc) and has a power output of approximately 25 watts between 152 and 162 mc and from 20 to 25 watts between 162 and 174 mc. This power output allows an operating range of approximately 25 miles under most conditions.

a. The equipment can be installed in several different types of vehicles such as railroad trains, jeeps, sedans, trucks, and ambulances. The cabinet that houses the receiver, the transmitter, and the transmitter power supply may be mounted in various positions to make installation easier. Because of its mobility, the radio set has certain

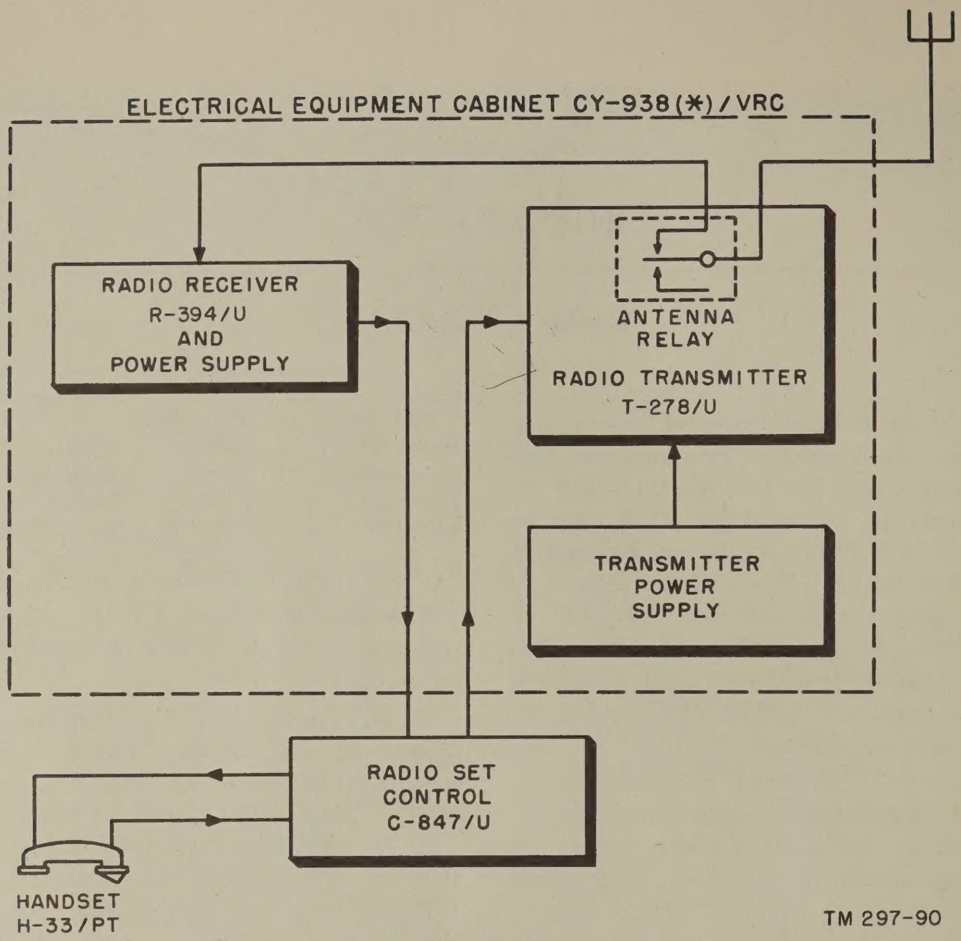

ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC
RADIO RECEIVER R-394/U AND POWER SUPPLY
ANTENNA RELAY
RADIO TRANSMITTER T-278/U
TRANSMITTER POWER SUPPLY
RADIO SET CONTROL C-847/U
HANDSET H-33/PT
TM 297-90

Figure 2. Radio set AN/VRC-19(*), block diagram.

limitations. It is usually operated from a battery, and the transmitter output is limited to 25 watts. The location of the radio set may not be favorable and because the antenna is near the ground it can be affected by obstructions such as trees, hills, and buildings.

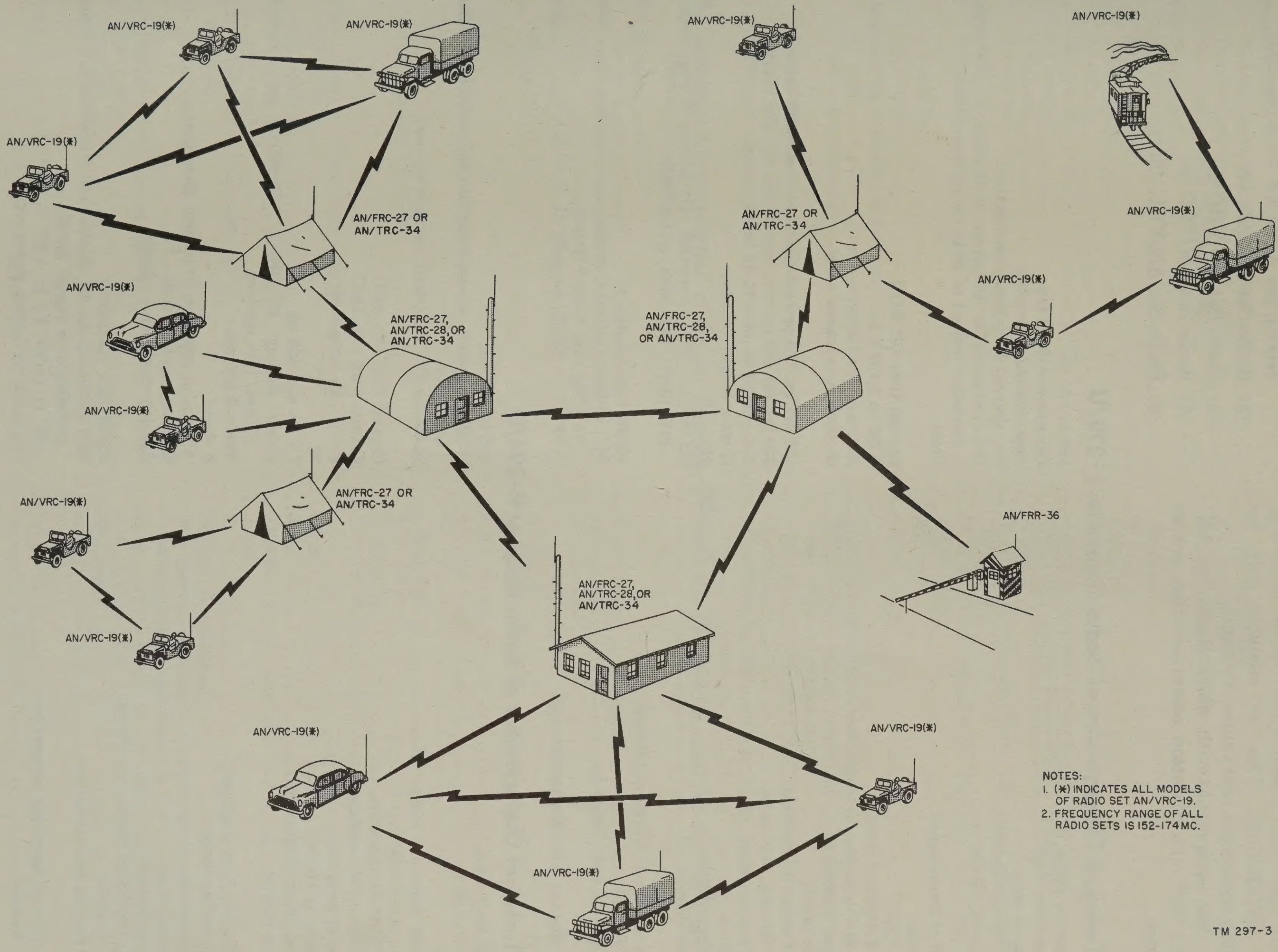
b. The radio set may be operated from a 6-, 12-, or 24-volt source. When the source voltage is changed, it is necessary to change the plug-in power supplies for the receiver and transmitter, and change the connections on the equipment cabinet.

c. The radio set may be controlled remotely, by using a remote control unit that has all the controls necessary for normal operation. Operation is simplified to the extent that the driver of the vehicle should be able to operate it; a qualified radio operator is not necessary.

d. The radio set consists of an equipment cabinet, a radio receiver, a receiver power supply, a radio transmitter, a transmitter power supply, a control unit, a control bracket, a control cable, a battery cable, and a mounting rack. Antennas are not included as components of the radio set. They are contained in separate installation kits that can be obtained through normal supply channels. The type of installation kit varies according to the intended use of the radio set. A block diagram of the radio set is shown in figure 2.

4. System Application

Radio Set AN/VRC-19(*) is a small, mobile receiving and transmitting station. It is one radio set in a group, which is collectively called the *nontactical series*. This group is divided into two frequency ranges: the *low band* covering 25 to 50 mc, and the *high band* covering 152 to 174 mc. Radio Set AN/VRC-19(*) operates in the high band and may be operated in conjunction with certain civilian police facilities if necessary. A typical network of high band radio sets is illustrated in figure 3. Many other combinations of the various radio sets are possible.



NOTES:
1. (✱) INDICATES ALL MODELS OF RADIO SET AN/VRC-19.
2. FREQUENCY RANGE OF ALL RADIO SETS IS 152-174 MC.

Figure 3. Radio set AN/VRC-19(*), nontactical series system application.

a. Two-way communication (one direction at a time) can be carried on with any of the radio sets in the high band group except Radio Receiving Set AN/FRR–36. This set contains only receiving equipment and cannot transmit.

b. The equipments with which Radio Set AN/VRC–19(*) can maintain communication are as follows:

(1) Radio Receiving Set AN/FRR–36 (only one-way communication to Radio Receiving Set AN/FRR–36 is possible).
(2) Radio Set AN/FRC–27.
(3) Radio Set AN/TRC–28.
(4) Radio Set AN/TRC–34.
(5) Radio Set AN/VRC–19(*).

5. Technical Characteristics of Radio Transmitter T–278/U

Frequency range	152 to 174 mc.
Transmitter type	Crystal-controlled fm.
Distance range	Approximately 25 miles.
Type of modulation	Fm, derived from phase modulation.
Frequency deviation	15-kc deviation for 100-percent modulation at 1,000 cycles. Deviation limited to 18 kc for all frequencies.
Type of transmission	Voice.
Crystals:	
Type	Crystal Unit CR–27/U.
Frequency range	4,750 to 5,437.5 kc.
Multiplication in transmitter	32 times on all frequencies.
Output impedance	50 ohms into coaxial cable.
Audio input:	
Carbon microphone	100 mv for 100 percent modulation at 1,000 cycles.
600-ohm line input	200 mv for 100 percent modulation at 1,000 cycles.
Spurious emission	Attenuated at least 70 db below carrier.
Antenna	¼ wave length vertical.
Number of tubes	13.
Power supply	External dc operated Dynamotor-Power Supply DY–100/U, DY–93/G, or DY–98/G.
Adaptability to service conditions:	
Altitude	10,000 feet, maximum.
Shocks and vibrations	Will withstand shocks, strains, and vibrations in a vehicle traveling over rugged terrain.
Normal operating temperature	−40° C. (−40° F.) to +65° C. (149° F.).

6. Technical Characteristics of Radio Receiver R–394/U

Frequency range	152 to 174 mc.
Receiver type	Dual conversion, crystal-controlled superheterodyne, fixed frequency.
Crystal frequency range	24.033 to 27.7 mc (third overtone crystal).
Type of Crystals:	
First hf oscillator	Crystal Unit CR–32/U.
Second hf oscillator	Crystal Unit CR–18/U.
Type of reception	Fm (15-kc deviation).
Number of tubes	22.
Intermediate frequencies	7.8 mc and 455 kc.
Power supply	Power Supply PP–867/U, PP–868/U, or PP–869/U plugged into receiver.
Audio-frequency response	300 to 3,500 cps.
Output impedance	8 ohms.
Power output	.5 watts at less than 10 percent distortion.
Antenna type	¼-wave length vertical.
Special features	Squelch and muting circuits.
Adaptability to service conditions:	
Altitude	10,000 feet, maximum.
Shocks and vibrations	Will withstand shocks, strains, and vibrations in a vehicle traveling over rugged terrain.
Normal operating temperature	−40° C. (−40° F.) to +65° C. (149° F.).
Weight	26 pounds (including power supply).

7. Technical Characteristics of Dynamotor-Power Supplies DY–100/U, DY–93/G, and DY–98/G (Transmitter Power Supplies)

Power input:	
Dynamotor-Power Supply DY–100/U	6 volts dc, 40 amp.
Dynamotor-Power Supply DY–93/G	12 volts dc, 20 amp.
Dynamotor-Power Supply DY–98/G	24 volts dc, 10 amp.
Power output:	
380 volts dc	180 ma.
225 volts dc	70 ma.
−25 volts dc	5 ma.
24 volts dc	1.2 amp (Dynamotor-Power Supply DY–98/G).
12 volts dc	2 amp (Dynamotor-Power Supply DY–93/G).
6.3 volts ac	2 amp (Dynamotor-Power Supply DY–98/G).
6 volts dc	.3 amp.
6 volts dc	.9 amp (Dynamotor-Power Supplies DY–100/U and DY–93/G).
6 volts dc	2 amp (Dynamotor-Power Supplies DY–100/U and DY–93/G).
1.3 volts dc	.2 amp.
1.3 volts dc	1 amp.
Adaptability to service conditions:	
Altitude	10,000 feet, maximum.
Shocks and vibrations	Will withstand shocks, strains, and vibrations in a vehicle traveling over rugged terrain.
Normal operating temperature	−40° C. (−40° F.) to +65° C. (149° F.).
Weight	24 pounds.
Dimensions	14½ in. long by 6⅞ in. wide by 8⅝ in. high.

8. Technical Characteristics of Power Supplies PP–867/U, PP–868/U, and PP–869/U (Receiver Power Supplies)

Rated input power:		
Power Supply PP–869/U	6 volts dc	3.7 amp.
Power Supply PP–868/U	12 volts dc	2.0 amp.
Power Supply PP–867/U	24 volts dc	1.1 amp.
Filament and heater circuit power outputs:		
Power Supply PP–869/U	6 volts dc	.45 amp.
	6 volts dc	1 amp.
	1.4 volts dc	1.2 amp.
Power Supply PP–868/U	6.3 volts ac	.45 amp.
	6.3 volts ac	1 amp.
	1.4 volts ac	1.2 amp.
Power Supply PP–867/U	6.3 volts ac	.45 amp.
	24 volts dc	250 ma.
	1.4 volts dc	1.2 amp.
Plate, screen, and bias circuit power drains:		
155 volts dc	15 ma.	
150 volts dc	5 ma.	
140 volts dc	50 ma.	
−40 volts dc	.5 ma.	
Adaptability to service conditions:		
Altitude	10,000 feet, maximum.	
Shock and vibration	Will withstand shocks, strains, and vibrations in a vehicle traveling over rugged terrain.	
Normal operating temperature	From −40° C. (−40° F.) to +70° C. (+158° F.).	
Dimensions	5 in. high by 6¼ in. wide by 7 in. long.	
Weight	10 pounds.	

9. Packaging Data

Radio Set AN/VRC–19(*) is packaged for either domestic or export shipment. When packaged for export shipment, the various components of the radio set are packed in small cardboard cartons that are contained in a wooden packing case. For domestic packaging, the smaller cartons are packed in two large cartons instead of the wooden packing case. The smaller individual cartons are packed the same for either type of shipment. A packing slip is attached to the outside of the case. The size, weight, and volume of the case or cartons are indicated in the following chart:

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

Type of packaging	Number of cases	Contents	Height (in.)	Width (in.)	Length (in.)	Volume (cu. ft.)	Unit weight (lb.)
Domestic	2	Radio set	25⅞	16½	27⅝	6. 8	156
		Accessories	12¼	16⅛	24½	4. 9	38
Export	1	Radio set and accessories	25⅞	16⅞	42⅛	10. 3	249

a. Export Packing. The transmitter, receiver, and transmitter and receiver power supplies are installed in the equipment cabinet. The cabinet is fastened to the mounting rack as it would be for installation in a vehicle. Pads are used on all corners of the cabinet for shock protection, and it is inclosed in a corrugated carton. The carton is sealed in a moisture-vaporproof bag and placed in a water-resistant carton that is inserted in the larger compartment in the wooden packing case. The smaller compartment of the case holds five cartons, containing the smaller components of the radio set. Figure 16 shows how the cartons are placed in the case.

b. Contents of Cartons. The following is a list of the contents of each carton in the case:

Package No.	Item
1	Electrical Equipment Cabinet CY–938(*)/VRC (with mounting brackets). Radio Transmitter T–278/U. Radio Receiver R–394/U. Dynamotor-Power Supply DY–100/U, DY–93/G, or DY–98/G. Power Supply PP–867/U, PP–868/U, or PP–869/U. Electrical Equipment Rack MT–1236/VRC.
2	Radio Set Control C–847/U.
3	Running spares.
4	Electrical Special Purpose Cable Assembly CX–2342/U (6- and 12-volt battery cable) or Electrical Power Cable Assembly CX–2343/U (24-volt battery cable). Electrical Special Purpose Cable Assembly CX–2341/U (control cable).
5	Instruction books or technical manuals.
6	Handset H–33/PT.

10. Table of Components

The crystals that determine the operating frequency are not supplied with the radio set. The correct crystal frequencies depend on the operating frequency assigned to the radio set in its particular field use. When the operating frequency is known, the required crystal frequencies may be found by using the methods described in paragraphs 85*a*(5) and 86*b*. The crystals then may be requisitioned through normal supply channels. The components (fig. 4) which make up the three models of Radio Set AN/VRC–19(*) are listed on following page.

Component	Radio Set AN/VRC-19Y	Radio Set AN/VRC-19X	Radio Set AN/VRC-19	Dimensions of components				
				Height (in.)	Width (in.)	Depth (in.)	Volume (cu. ft.)	Weight (lb.)
Radio Receiver R-394/U	1	1	1	8½	5¾	14½	0. 43	16
Power Supply PP-869/U	1	0	0	5	6¼	7	. 12	10
Power Supply PP-868/U	0	1	0	5	6¼	7	. 12	10
Power Supply PP-867/U	0	0	1	5	6¼	7	. 12	10
Radio Transmitter T-278/U	1	1	1	8½	4½	14½	. 33	8½
Dynamotor-Power Supply DY-100/U	1	0	0	8⅝	6⅞	14½	. 36	24
Dynamotor-Power Supply DY-93/G	0	1	0	8⅝	6⅞	14½	. 36	24
Dynamotor-Power Supply DY-98/G	0	0	1	8⅝	6⅞	14½	. 36	24
Electrical Equipment Cabinet CY-938(*)/VRC (with hardware)	1	1	1	10½	19⁵⁄₁₆	16½	1. 05	33
Radio Set Control C-847/U	1	1	1	5	7½	2¼	. 07	4½
Electrical Equipment Rack MT-1236/VRC	1	1	1	7⅝	23⅜	10¾	-------	10½
Electrical Special Purpose Cable Assembly CX-2342/U	1	1	0	-------	-------	192	-------	-------
Electrical Power Cable Assembly CX-2343/U	0	0	1	-------	-------	147	-------	-------
Electrical Special Purpose Cable Assembly CX-2341/U	1	1	1	-------	-------	35⅛	-------	-------
Handset H-33/PT	1	1	1	-------	-------	-------	-------	-------
Control Bracket	1	1	1	2¹¹⁄₁₆	9¾	⅛	-------	-------
Kit, running spares	1	0	0	6	8	8	. 22	-------
Kit, running spares	0	1	0	6	8	8	. 22	-------
Kit, running spares	0	0	1	6	8	8	. 22	-------
Instruction book for Radio Set AN/VRC-19(*) or TM 11-297	2	2	2	8½	11	½	. 03	1
Instruction book or technical manual for Radio Receiver R-394/U	2	2	2	8½	11	½	. 03	1
Instruction book or technical manual for Radio Transmitter T-278/U	2	2	2	8½	11	½	. 03	1
Instruction book for Power Supplies PP-867/U, PP-868/U, and PP-869/U or TM 11-5079	2	2	2	8½	11	½	. 03	1
Instruction book or technical manuals (Dynamotor-Power Supplies DY-100/U, DY-98/G, and DY-93/G)	2	2	2	8½	11	½	. 03	1

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

11. Description of Electrical Equipment Cabinet CY-938(*)/VRC

(figs. 5 and 28)

Electrical Equipment Cabinet CY-938(*)/VRC is used to house the receiver, transmitter, and transmitter power supply. It is made of aluminum with spot-welded construction and is coated with a semigloss olive-drab enamel. The equipment cabinet consists of a body, two covers, and two brackets. The two brackets are for mounting the cabinet on the mounting rack. The covers, which are identical, are held on by six trunk-type latches and provide waterproof protection for the components and parts within the cabinet. There are two entrance holes on the left-hand side of the equipment cabinet for the battery and control cables. A third hole, on the right-hand side, may be used to insert the power cable from that side. The entrance hole that is not in use may be filled with a threaded plug or used for inserting a second antenna cable when the radio set is used as a radio relay station. Rails mounted within the equipment cabinet are pulled in an upward direction by springs attached to the rear of the cabinet. These rails hold the components firmly in place after they are installed. Jacks are provided in the rear to interconnect the three plug-in components when they are inserted. Terminal boards, which may be reached from the rear, allow connections to external circuits. Fuse F801 (50 amperes), which is replaceable from the front when the receiver is removed, protects the primary

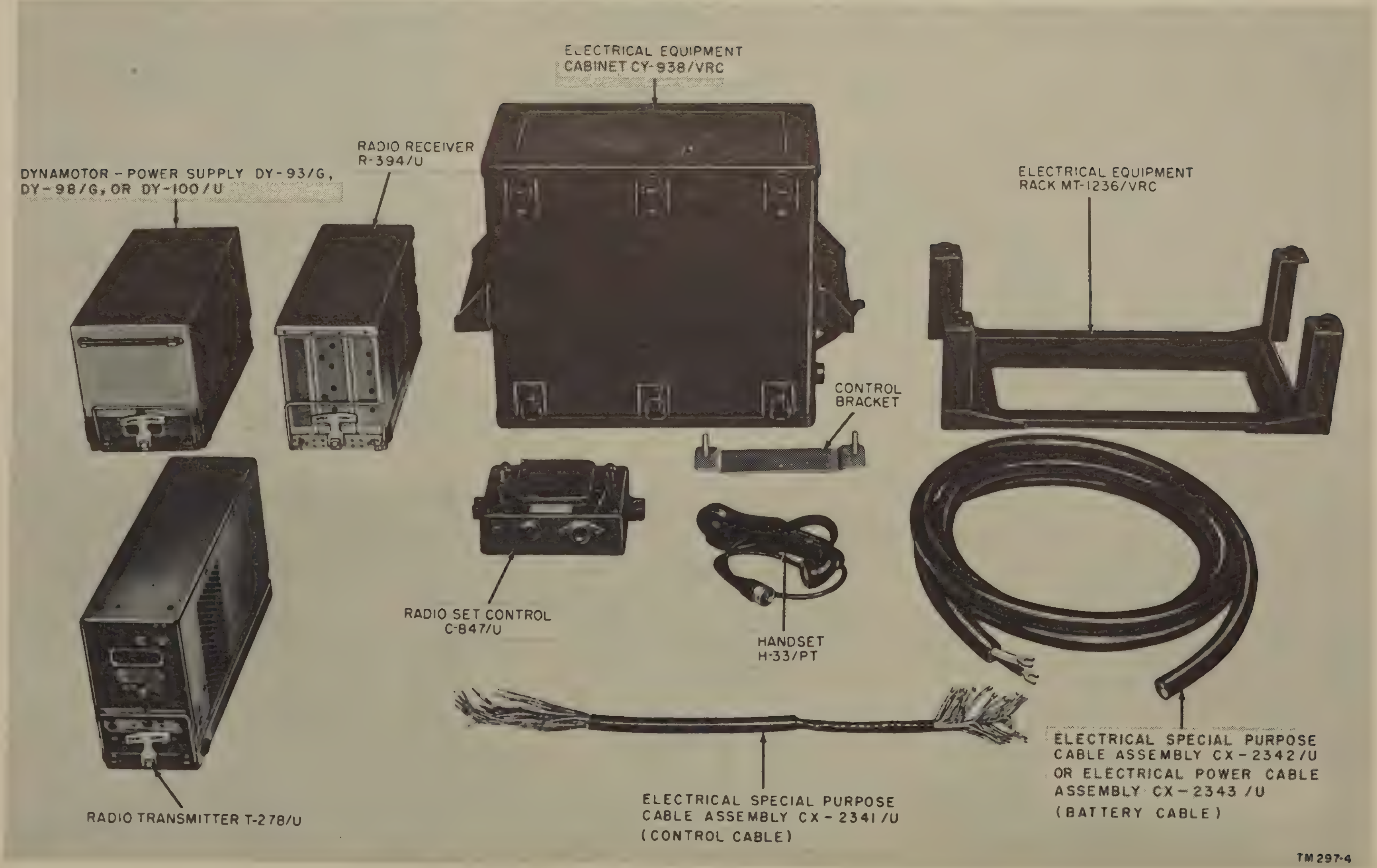

ELECTRICAL EQUIPMENT CABINET CY-938/VRC
RADIO RECEIVER R-394/U
DYNAMOTOR - POWER SUPPLY DY-93/G, DY-98/G, OR DY-100/U
ELECTRICAL EQUIPMENT RACK MT-1236/VRC
CONTROL BRACKET
RADIO SET CONTROL C-847/U
HANDSET H-33/PT
ELECTRICAL SPECIAL PURPOSE CABLE ASSEMBLY CX-2342/U OR ELECTRICAL POWER CABLE ASSEMBLY CX-2343/U (BATTERY CABLE)
ELECTRICAL SPECIAL PURPOSE CABLE ASSEMBLY CX-2341/U (CONTROL CABLE)
RADIO TRANSMITTER T-278/U
TM 297-4

Figure 4. Radio set AN/VRC-19(*), operating components.

power source from damage caused by overload. Nine threaded holes on each side of the equipment cabinet permit two types of mounting (par. 26*c*).

12. Description of Radio Transmitter T–278/U
(fig. 6)

Radio Transmitter T–278/U is a crystal-controlled fm transmitter capable of operation in the frequency range of 152 to 174 mc. It uses 13 tubes and has a power output of approximately 25 watts. Two separate oscillators are used to permit a choice of either of two preset frequencies. The frequency modulation is accomplished by the phase-shift method that permits direct crystal control of the carrier frequency.

a. The transmitter uses a separate power supply for power and a control unit for operating controls. It is a plug-in type component, and all external connections are made through a 32-contact male connector located on the rear of the transmitter. Controls and test points for alining the transmitter are located on the front panel. A folding handle provides a means of removing the transmitter from the equipment cabinet when replacement, tuning, or repair is necessary.

b. A vertical antenna, cut for ¼-wave length at the operating frequency, is coupled to the transmitter through a length of Radio Frequency Cable RG–58C/U. An antenna changeover relay is incorporated in the circuit so that the same antenna can be used for reception when the transmitter is not in use.

13. Description of Radio Receiver R–394/U
(fig. 7)

a. Radio Receiver R–394/U is a 22-tube fm dual-conversion superheterodyne receiver. It operates at a crystal-controlled frequency within the frequency range of 152 to 174 mc. The high-frequency oscillators are crystal-controlled to provide maximum stability. The receiver connections to the radio set are made through a 31-contact male connector located on the rear panel. Connections are made automatically when the receiver is installed in the equipment cabinet. All controls that affect the receiver during normal operation are located on the control unit.

b. The receiver consists of a base assembly and six plug-in subassemblies for the various groups of stages. The base has interconnecting wiring

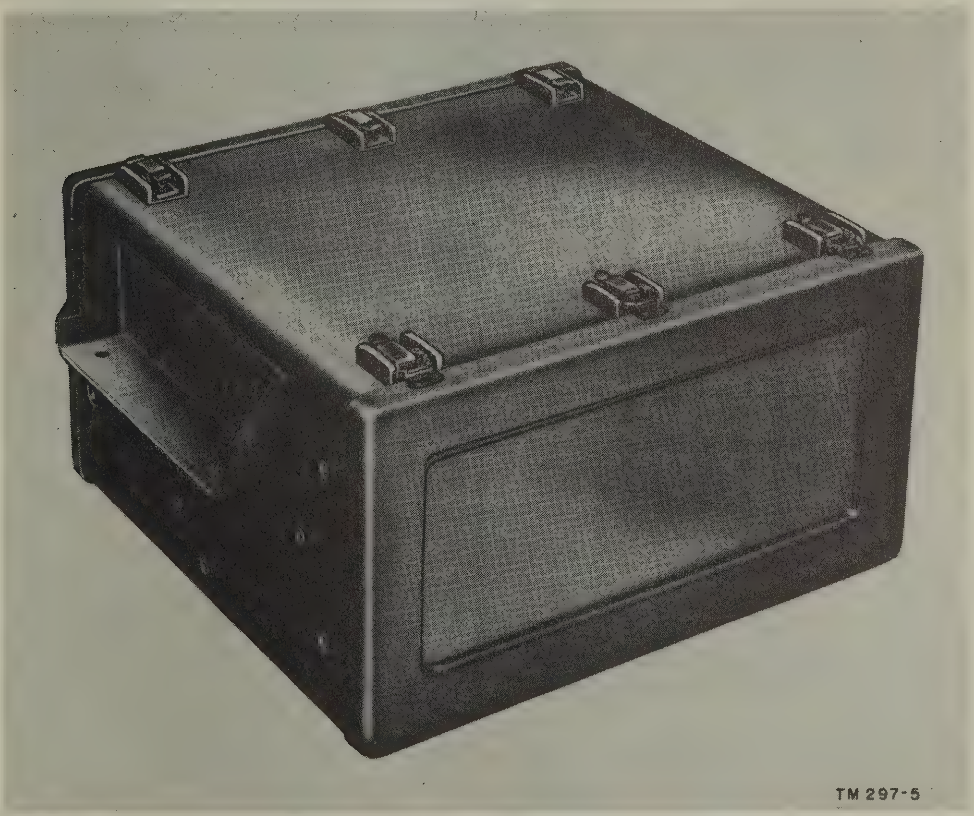


Figure 5. Electrical equipment cabinet CY–938/VRC.

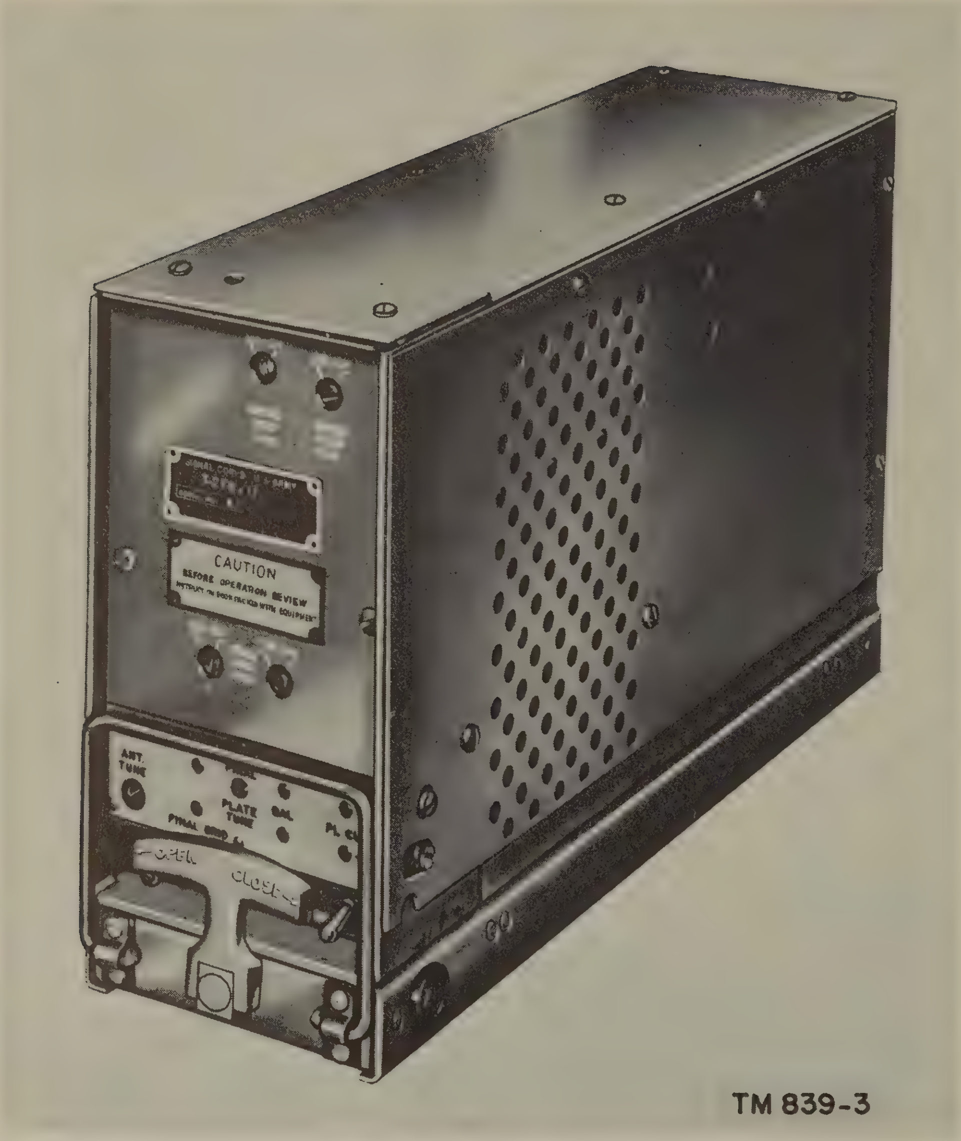


Figure 6. Radio transmitter T–278/U.

and jacks to complete the signal and current paths through the receiver. This construction permits rapid servicing and a minimum of stock parts for replacement. Each subassembly occupies a shielded compartment and is further shielded by a metal cover that slides over the unit.

c. A separate receiver compartment houses the receiver power supply, which is a separate component. The power supply, when plugged into the receiver, must be capable of operating at the correct input voltage for the radio set in which it is installed. The receiver is designed to use Power Supply PP–869/U, PP–868/U, or PP–867/U for 6-, 12-, or 24-volt operation, respectively. Refer to paragraph 8 (and to TM 11–5079, Power Supplies, PP–867/U, PP–868/U, and PP–869/U) for the technical characteristics of the receiver power supplies.

d. The receiver normally operates at a single preset frequency. To change this frequency, it is necessary to change a crystal in the local oscillator subassembly and realine all the stages preceding the first mixer. This operation should not be attempted by the operator; it must be performed by a competent radio repairman who is familiar with repair techniques of this equipment.

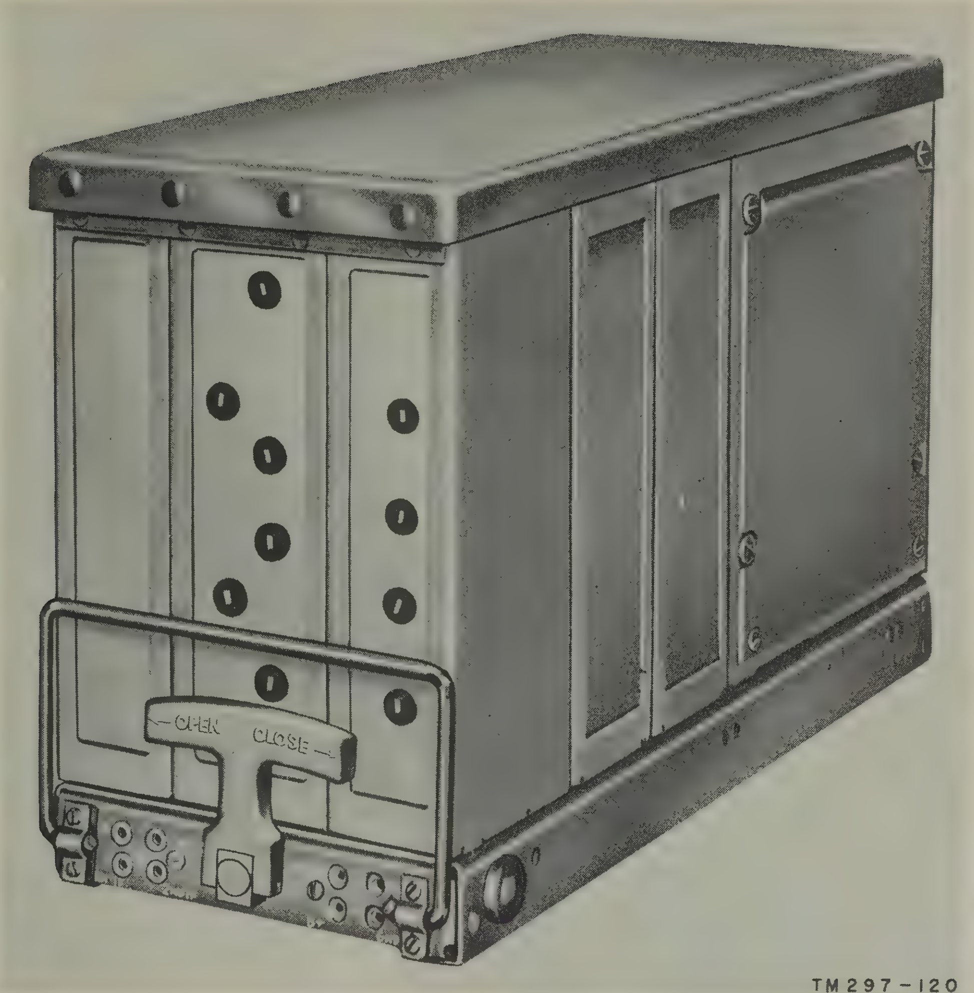


Figure 7. Radio receiver R–394/U.

14. Description of Radio Set Control C–847/U

(fig. 8)

Radio Set Control C–847/U is used to control the operation of the radio set. It consists of a small waterproof metal box that contains the operating controls and a speaker for monitoring purposes. It is mounted either on the radio set or at some other location in the vehicle, usually the instrument panel. Mounting is accomplished by means of a flange on each side of the box. These flanges are slotted so that they will mate with the stud bolts on the control bracket (if used). The bracket is attached to the vehicle or to the equipment cabinet, and allows the control to be removed easily for repair. The control unit contains 4 controls, 2 pilot lamps, a speaker, audio attenuator pads, and connectors which—

a. Turn power on and off for the radio set.

b. Indicate when the power is on.

c. Indicate when the transmitter is on.

d. Select either of two preset transmitter frequencies.

e. Control the receiver squelch operating level, and provide a means of disabling the squelch circuit.

f. Control the volume of the monitor speaker and handset.

g. Provide interconnection from the handset to the receiver or to the transmitter for normal operation.

15. Description of Dynamotor-Power Supplies DY–100/U, DY–93/G, and DY–98/G

(fig. 9)

a. Dynamotor-Power Supplies DY–100/U, DY–93/G, and DY–98/G are 6-, 12-, and 24-volt transmitter power supplies used with Radio Sets

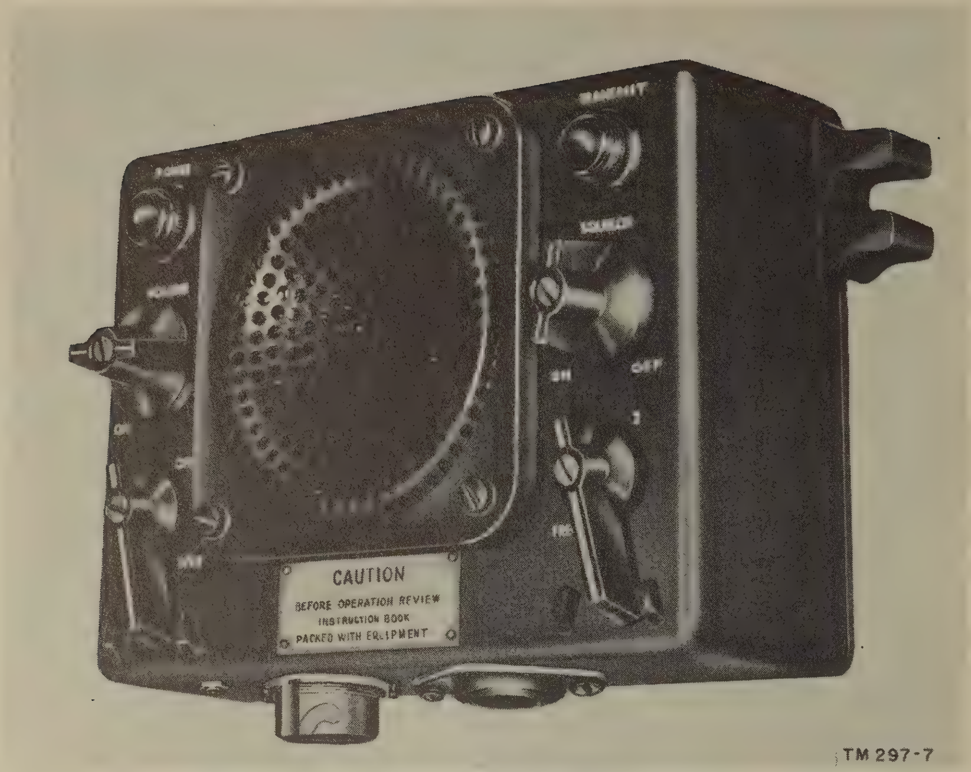


Figure 8. Radio set control C–847/U.

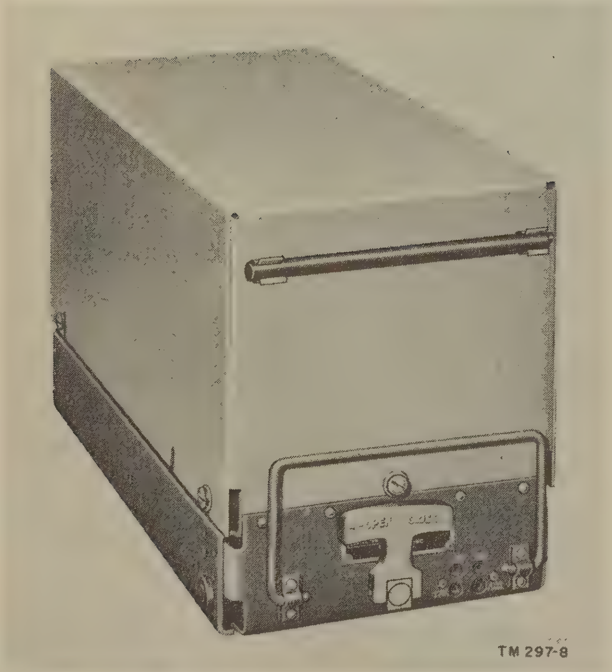


Figure 9. Dynamotor-power supply DY–100/U, DY–93/G, or DY–98/G, oblique view.

AN/VRC–19Y, –19X, and –19, respectively. The power supplies change 6-, 12-, or 24-volt battery power to voltages needed to operate the transmitter.

b. When the power supply is inserted in its position in the equipment cabinet, all connections to other components of the set and the power source are made automatically by a 32-contact male plug at the rear of the power supply. It is held firmly in place by a lock-in assembly with a control handle on the front panel. A separate handle to remove the unit from the equipment cabinet and four voltage test points are also available on the front panel. The unit is protected by two covers; one for the top, sides, and front, and one for the bottom. Refer to paragraph 7 for technical characteristics of the transmitter power supplies.

Note. Transmission time should be limited to a maximum of 3 minutes of continuous operation to prevent overheating the dynamotors. If the dynamotors are used continuously for 3 minutes, a cooling period of 12 minutes must be allowed before the next transmission.

16. Power Supplies PP–869/U, PP–868/U, and PP–867/U (Receiver)

(fig. 10)

a. The receiver power supply is constructed on an individual chassis, designed to occupy a compartment in the receiver. Three different models are available to provide operation with vehicular voltage sources of 6, 12, or 24 volts. Interconnection between the power and control circuits is made through a 15-contact female connector that connects to a mating connector on the receiver base. There are no controls on the power supplies.

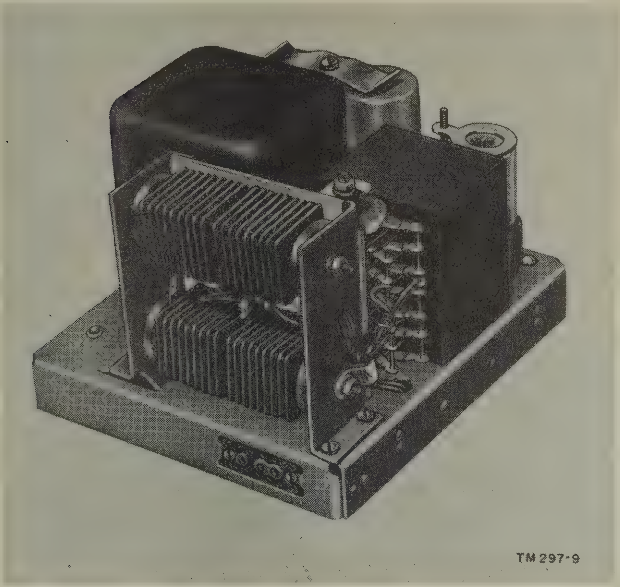


Figure 10. Power supply PP–867/U, PP–868/U, or PP–869/U (receiver).

b. Power Supply PP–869/U is used with Radio Set AN/VRC–19Y to adapt the receiver to a 6-volt direct-current (dc) power source. Power Supply PP–868/U permits the receiver to be used with Radio Set AN/VRC–19X, which operates from a 12-volt dc power source. Power Supply PP–867/U, 24 volts, is used with Radio Set AN/VRC–19. Figure 10 is representative of all three power supply models.

17. Antenna

The antenna used with the radio set is not supplied with the equipment but is contained in one of two general purpose installation kits (par. 3*d*). One kit is used for hard-top vehicles such as sedans or ambulances. It contains a 17-inch whip antenna which is mounted vertically at the center of the vehicle roof. The second installation kit is used for other than hard-top vehicles (jeeps or command cars). It contains a coaxial antenna (fig. 11) that consists of a wire (17 inches long) and a skirt mounted on a supporting mast. The antenna is fed by a coaxial cable (supplied with the antenna) which passes through the supporting mast. The height of the antenna may be adjusted by loosening the adjusting nut on the supporting mast. The supporting mast is connected to a mounting bracket by means of a spring to prevent damage if the antenna hits obstructions.

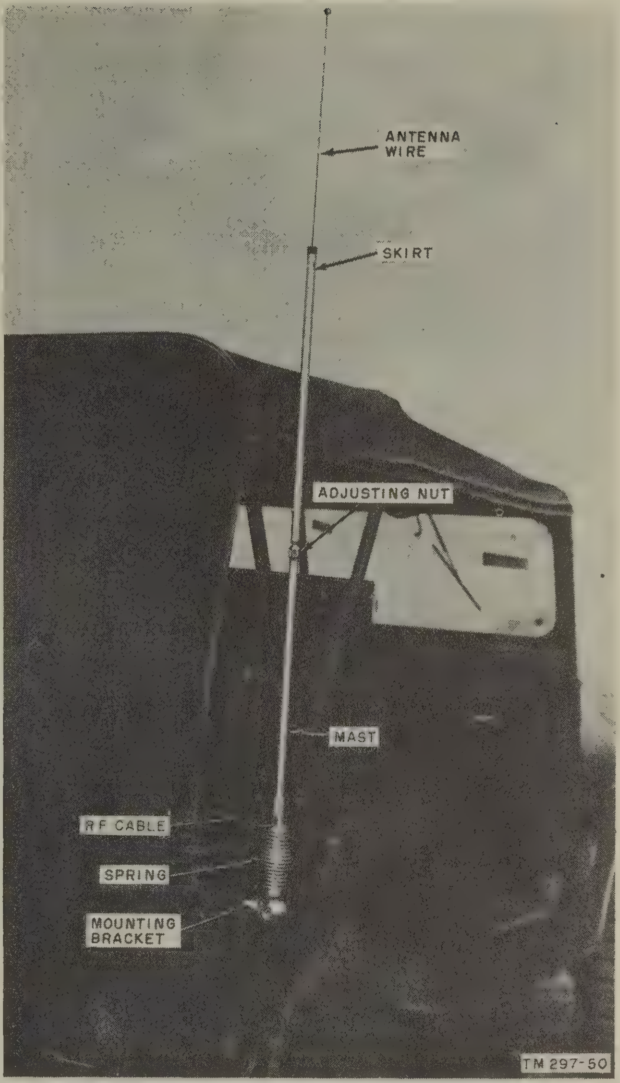


Figure 11. Coaxial antenna mounted on a jeep.

18. Electrical Equipment Rack MT–1236/VRC

(fig. 12)

Electrical Equipment Rack MT–1236/VRC is a metal support that cradles Electrical Equipment Cabinet CY–938(*)/VRC. The equipment cabinet rests on four rubber shock mounts, which are on posts that extend approximately 7 inches from the base of the mounting rack. These keep the equipment cabinet from touching anything but the mounts and permits two methods of mounting. The base of the mounting rack has 24 holes, which allow it to be secured to a vehicle in various ways.

19. Control Bracket

(fig. 13)

The control bracket is used to mount the control unit. It is a flat metal plate with three mounting holes that mate with the threaded holes on the side of the equipment cabinet. Two threaded studs, projecting from the plate, hold the control unit with the aid of nuts and washers. Although the control bracket is designed to secure the control unit to the equipment cabinet, it also can be used at other locations in the vehicles.

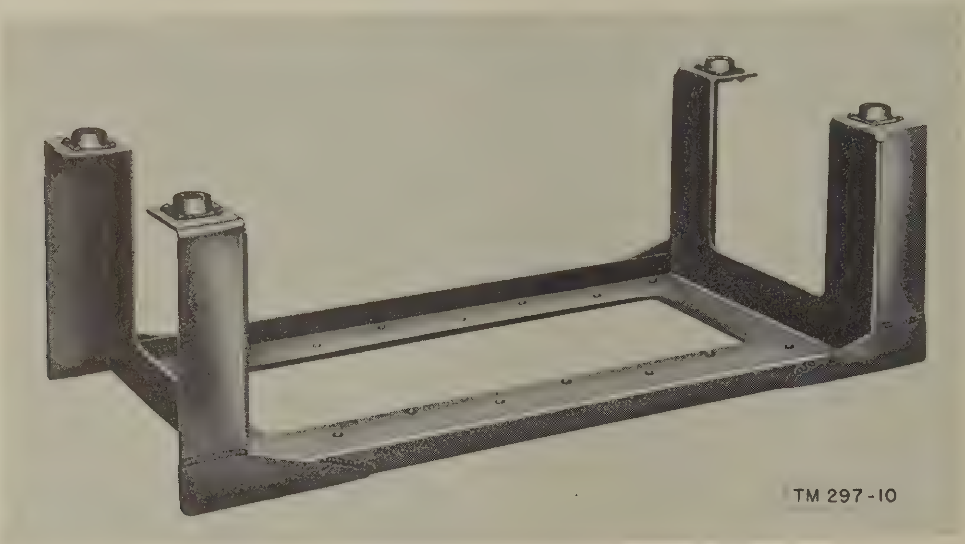


Figure 12. Electrical equipment rack MT–1236/VRC.

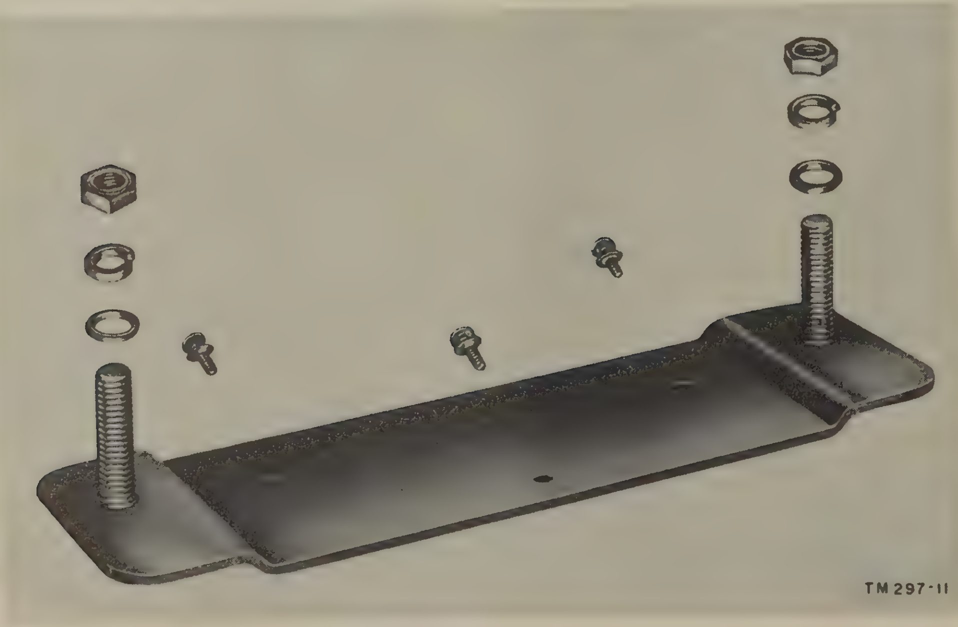


Figure 13. Control bracket.

20. Handset H–33/PT and Handset Holder

Handset H–33/PT (fig. 14) is a combination microphone and receiver with a push-to-talk switch and connecting cord. The carbon button microphone has a resistance of 40 ohms. The impedance of the receiver is approximately 300 ohms. A double-pole, single-throw (DPST) switch is provided for push-to-talk operation. The connecting cord is 6½ feet long and is terminated in a 10-pin audio connector that mates with the HANDSET connector on the control unit. A handset holder is included with the radio set to provide a means of securing the handset when it is not in use. The holder is packed with the spare parts and consists of a mounting bracket and clip assembly. It can be mounted on the control unit or any other convenient location within the limits of the handset connecting cord length. Refer to paragraph 26*f* for assembly and installation details.

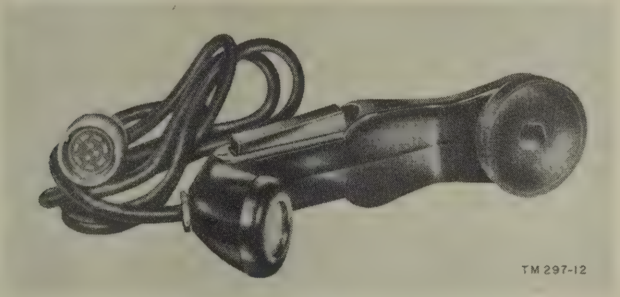


Figure 14. Handset H–33/PT.

21. Cables

a. Electrical Special Purpose Cable Assembly CX–2342/U and Electrical Power Cable Assembly CX–2343/U (Battery Cables). The battery cable (fig. 15) used with the radio set varies in characteristics, depending on the type of vehicle in which it is installed and the voltage of the vehicular electrical system. In a jeep installation, for instance, the cable may be shorter than in a sedan or truck installation. The same sized wire is used with both the 6- and 12-volt systems. The 24-volt cables have thinner wires because they carry less current. Each battery cable is made up of two heavy-current insulated wires encased in a heavy-duty rubber coating. The ends of the wires that connect to the equipment cabinet have eye-type lugs soldered to them. The 6- and 12-volt systems use Electrical Special Purpose Cable Assembly CX–2342/U, and the 24-volt system uses Electrical Power Cable Assembly CX–2343/U.

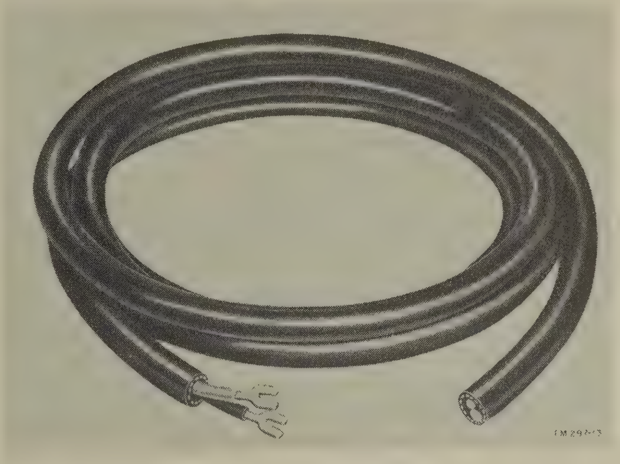


Figure 15. Battery cable.

b. Electrical Special Purpose Cable Assembly CX–2341/U (Control Cable). The control cable (fig. 4) consists of 20 wires cabled together and cut to reach between the control unit and the equipment cabinet. In installations where the control unit is located on the equipment cabinet, such as for jeeps, the cable is approximately 18 inches long. In other types of installations, where the control unit is mounted some distance from the equipment cabinet, the length of the cable may be 16 feet or longer. The necessary length of cable for any particular type of installation is included in the appropriate kit for that type of installation. Installation kits are not supplied with the radio set but must be ordered through normal supply channels. The lead that carries the microphone audio signal is shielded. This shield is grounded at the equipment cabinet end *only*.

22. Running Spares

A group of running spares is supplied with each radio set. Spares are provided for all normally expendable items such as tubes, fuses, pilot lamps, and vibrators. Each of the three radio sets has a different set of running spares. In all models, the running spares are packed in the same packing case as the equipment. The following is a list of the running spares provided for the three models of the equipment:

Item	Equipment		
	Radio Set AN/VRC-19Y	Radio Set AN/VRC-19X	Radio Set AN/VRC-19
Tube, electron type 1AD4	3	3	3
Tube, electron type 5840	1	1	1
Tube, electron type 5678	4	4	4
Tube, electron type 6AK6	1	1	1
Tube, electron type 5672	2	2	2
Tube, electron type 2E24	2	2	2
Tube, electron type 3B4	1	1	1
Tube, regulator (receiver power supply)	2	2	2
Tube, regulator (transmitter power supply)	4	4	4
Lamp, incandescent, 6 to 8 v, 0.15 amp	1	1	1
Vibrator, 24 v	0	0	2
Vibrator, 6 v	1	0	0
Vibrator, 12 v	0	1	0
Fuse, link type, 50 amp	2	2	2
Fuse, ceramic body, cartridge type, 8 amp	2	0	0
Fuse, cartridge, 15 amp	2	0	0
Fuse, cartridge, 3 amp	0	0	5
Fuse, cartridge, 5 amp	0	5	0
Fuse, cartridge, 6 amp	0	0	2
Fuse, cartridge, 10 amp	0	2	0
Fuse, cartridge, 20 amp	0	0	2
Brush, dynamotor output	2	2	2
Brush, dynamotor input, 6 v	2	0	0
Brush, dynamotor input, 12 v	0	2	0
Brush, dynamotor input, 24 v	0	0	2
Handset Holder	1	1	1

23. Difference in Models

a. The radio set is available in three different models, each designed to operate from a different voltage source. Basically, the models are the same. Certain differences do exist because of the different voltage sources and types of installation. The type of antenna will vary with the type of installation (par. 17). Certain components of the radio sets are changed with the voltage source. The particular component associated with each model of radio set, and therefore the difference in models, is indicated in the chart below:

Item	Radio Set AN/VRC-19Y	Radio Set AN/VRC-19X	Radio Set AN/VRC-19
Power Supply PP-869/U	X		
Power Supply PP-868/U		X	
Power Supply PP-867/U			X
Dynamotor-power Supply DY-93/G		X	
Dynamotor-power Supply DY-98/G			X
Dynamotor-power Supply D-100/U	X		
Electrical Special Purpose Cable Assembly CX-2342/U (power cable)	X	X	
Electrical Power Cable Assembly CX-2343/U (power cable)			X
Running spares (6 v)	X		
Running spares (12 v)		X	
Running spares (24 v)			X

b. Two models of the equipment cabinet are presently in use; Electrical Equipment Cabinet CY-938/VRC and Electrical Equipment Cabinet CY-938A/VRC. The A model differs from the unlettered model only in the position of the trunk-type latches used to fasten the covers. On the unlettered model, these latches are mounted on the cabinet and their mating hooks are mounted on the covers. The positioning of these parts has been reversed on the A model; the latches are mounted on the covers and the hooks are mounted on the cabinet.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

24. Siting

a. Location in Vehicle. The location of Radio Set AN/VRC–19(*) in a vehicle is determined by the type of vehicle in which it is used. Installation instructions are included with the installation kits for particular types of vehicles.

b. Effects of Surroundings. Better operation of the equipment can be expected when the surrounding land is flat or when the vehicle is on the top of a hill. Hills, cliffs, densely wooded areas, buildings, and other obstructions in the transmission path can cause a serious loss in the range of the set. Valleys and other low places are poor locations for radio reception and transmission because the surrounding high land absorbs the signal. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, underpasses, power lines, hospitals, or power units. Whenever possible, try to move the vehicle away from an undesirable location before operating the radio set.

25. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 28.

a. Unpacking (fig. 16). Be careful not to damage the radio set or other parts when unpacking the equipment. Do not drop the packing case or poke through the smaller cartons with a sharp instrument; this can cause damage to the packed equipment. When taking the package apart, do not exert too much pressure upon the contents. If possible, unpack the equipment in a location that is dry and free from dust or dirt. To quickly and safely remove the equipment from the case, follow the unpacking instructions in the order given.

(1) Cut the metal bands, encircling the wooden packing case. If possible, use a pair of tin snips or a pair of large cutting pliers.

(2) Pry open the top cover; be careful not to force the prying instrument too far into the package. Remove the top cover and save it for possible repacking (save all the packaging material except the silica gel).

(3) Take out the small packages containing the instruction books or technical manuals, running spares, and cables.

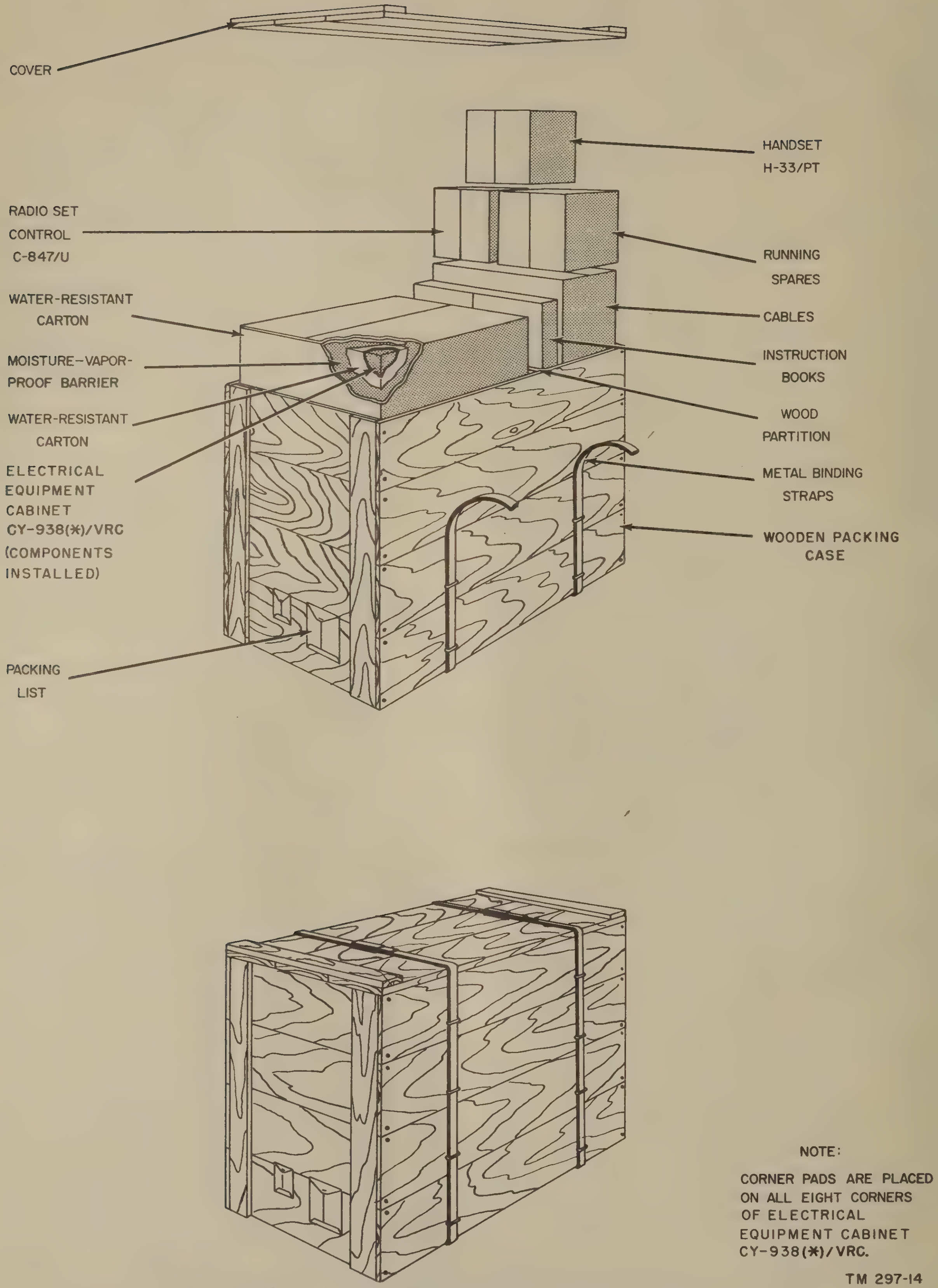
(4) Place the case on its side and slide out the large package containing Electrical Equipment Cabinet CY–938(*)/VRC and components.

(5) Open the flaps on the cartons and remove the contents.

(6) Slit the moisture-vaporproof bag (in the large carton) along its seam and remove the equipment cabinet.

(7) The individual spare parts and other parts are wrapped and marked separately. Remove the wrappings of all the parts to be used.

b. Checking. Always check equipment for damage that may have happened during shipment. Remove each of the conponents and check them for damage such as broken tubes, resistors, cut wires, shorted terminals, bent capacitor plates, and smashed transformer cans. To remove a component, rotate the lock-in rod handle 360° in a counterclockwise direction, and pull the component from the equipment cabinet. Check all parts against the packing list that is in an envelope tacked to the outside of the case. It is necessary to remove the covers on the components to check the tubes and other parts. The receiver top cover is secured by a single latch at the rear of the receiver. After removing this cover, any of the plug-in units may be pulled out with the exception of the receiver power supply. To remove the receiver power supply, take out six screws. It then can be removed from the chassis and, at the same time, the plug to the receiver base can



NOTE:

CORNER PADS ARE PLACED ON ALL EIGHT CORNERS OF ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC.

Figure 16. Radio set AN/VRC-19(*), export packaging.

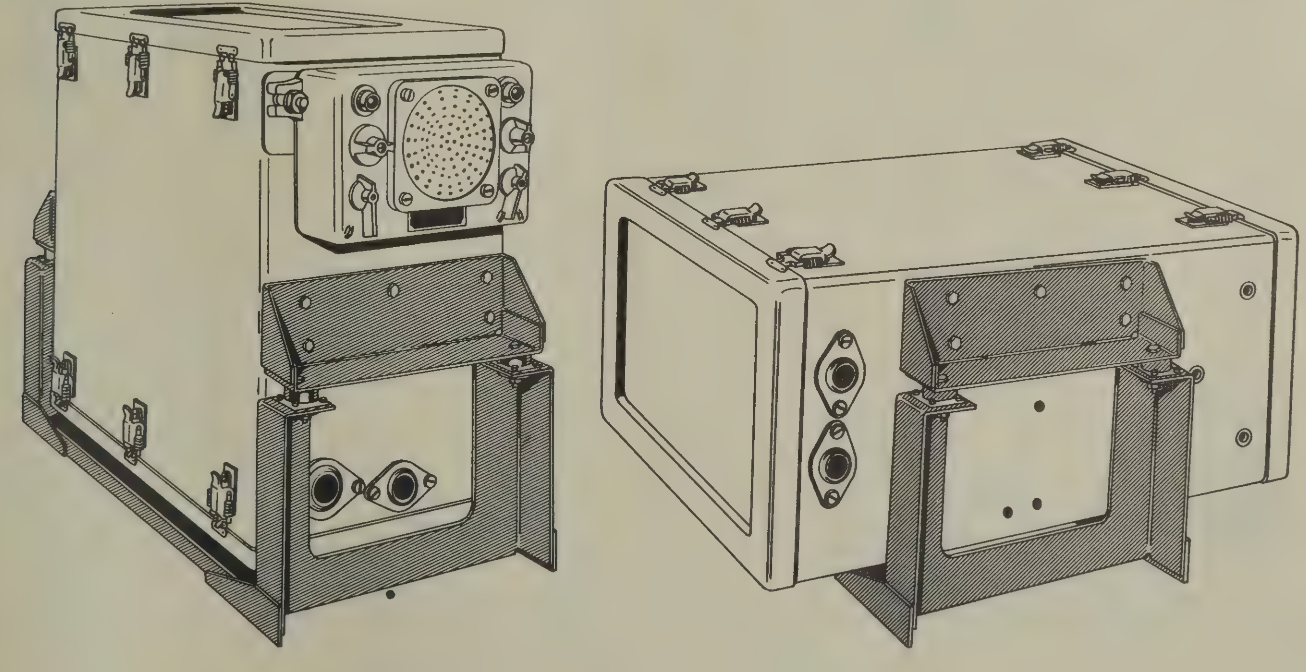
be disconnected. The transmitter power supply cover is secured by six screws. It is not necessary to remove the screws completely because the cover has open slots that permit it to be lifted from the power supply when the screws are loosened. When all the components have been checked and it is reasonably sure that there is no damage, replace the receiver power supply and component covers by reversing the procedure used for disassembly.

26. Installation of Equipment

a. General. There are two methods of mounting Radio Set AN/VRC–19(*). The method with the front panels of the components facing upward will be called the vertical mounting, and the method with the front panels of the components facing to the side will be called horizontal mounting. The two methods of mounting are shown in figure 17. If the equipment cabinet is to be located so that the front and rear covers cannot be removed after installation, the wiring and connections to the radio set must be made before the equipment cabinet is mounted. In this case, refer to paragraph 27 before proceeding with the installation.

b. Installation of Electrical Equipment Rack MT–1236/VRC. Install Electrical Equipment Rack MT–1236/VRC in a vehicle where a suitable mounting surface is available. If possible, locate the rack so that there is enough surrounding space to allow access to both the front and rear of the equipment cabinet. In some vehicles, threaded mounting holes will be available. In most vehicles, however, it will be necessary to drill and tap (thread) the holes. Six holes are enough to secure the rack. Choose the holes in the base of the mounting rack that are to be used for installing it. If it is not possible to use the mounting rack as a guide when drilling the holes in the vehicle, make a drawing of the exact spacing of these holes on a piece of paper or cardboard (a template), and use it as a guide. The dimensions for the mounting rack and the holes in its base are shown in figure 18. Use ¼-inch bolts and lockwashers to secure the rack to the vehicle. If the holes cannot be threaded, nuts must be used on the other side of the mounting surface.

c. Installation of Electrical Equipment Cabinet CY–938(*)/VRC. If necessary, make the wiring connections described in paragraph 27 before the equipment cabinet is installed. Replace the rear cover on the cabinet when the wiring connections have been made. Fasten the two mounting brackets to the equipment cabinet in either the



VERTICAL MOUNTING

HORIZONTAL MOUNTING

Figure 17. Methods of mounting electrical equipment cabinet CY–938(*)/VRC.

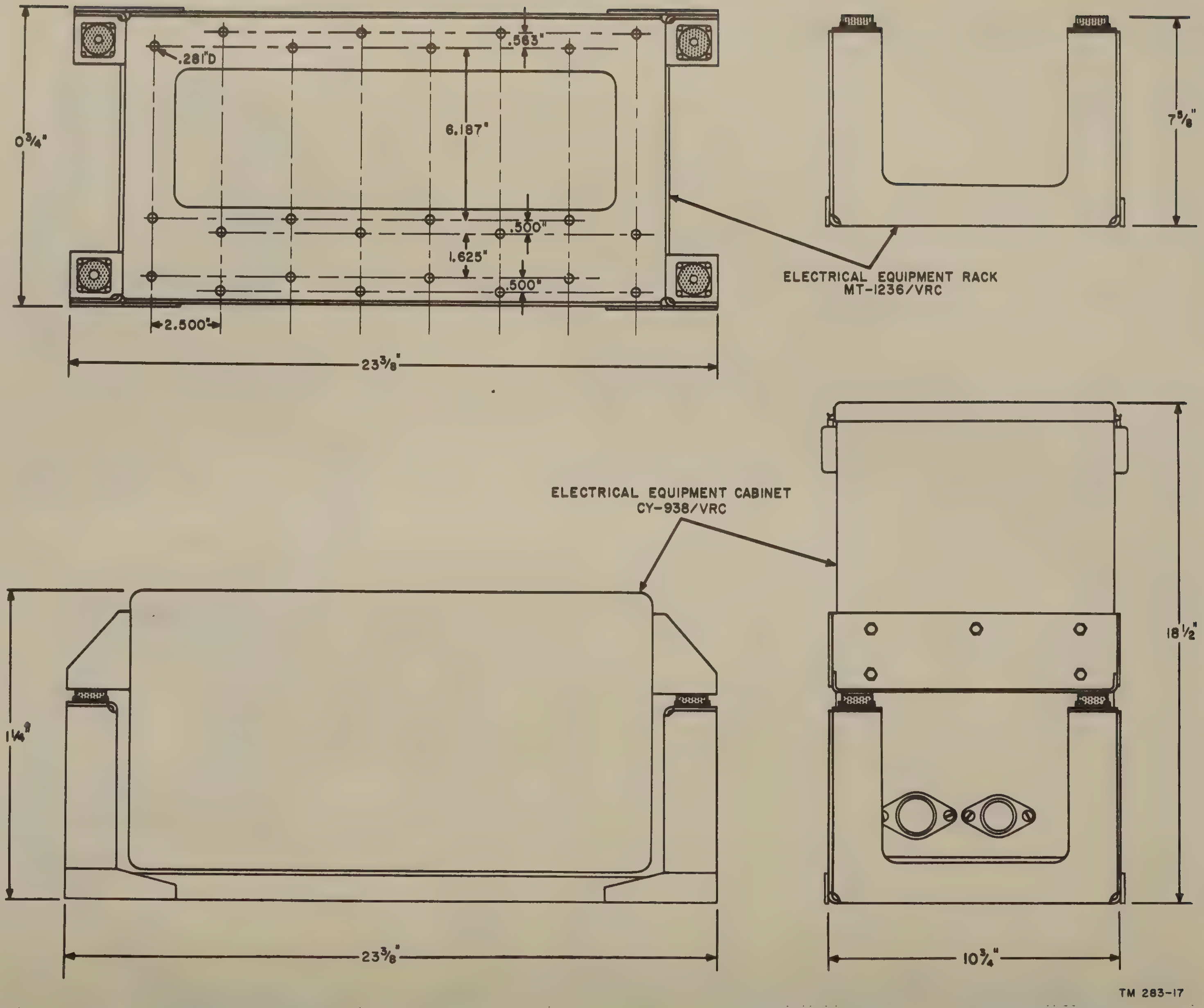


Figure 18. Electrical equipment rack MT-1236/VRC and electrical equipment cabinet CY-938/VRC, dimensional drawing.

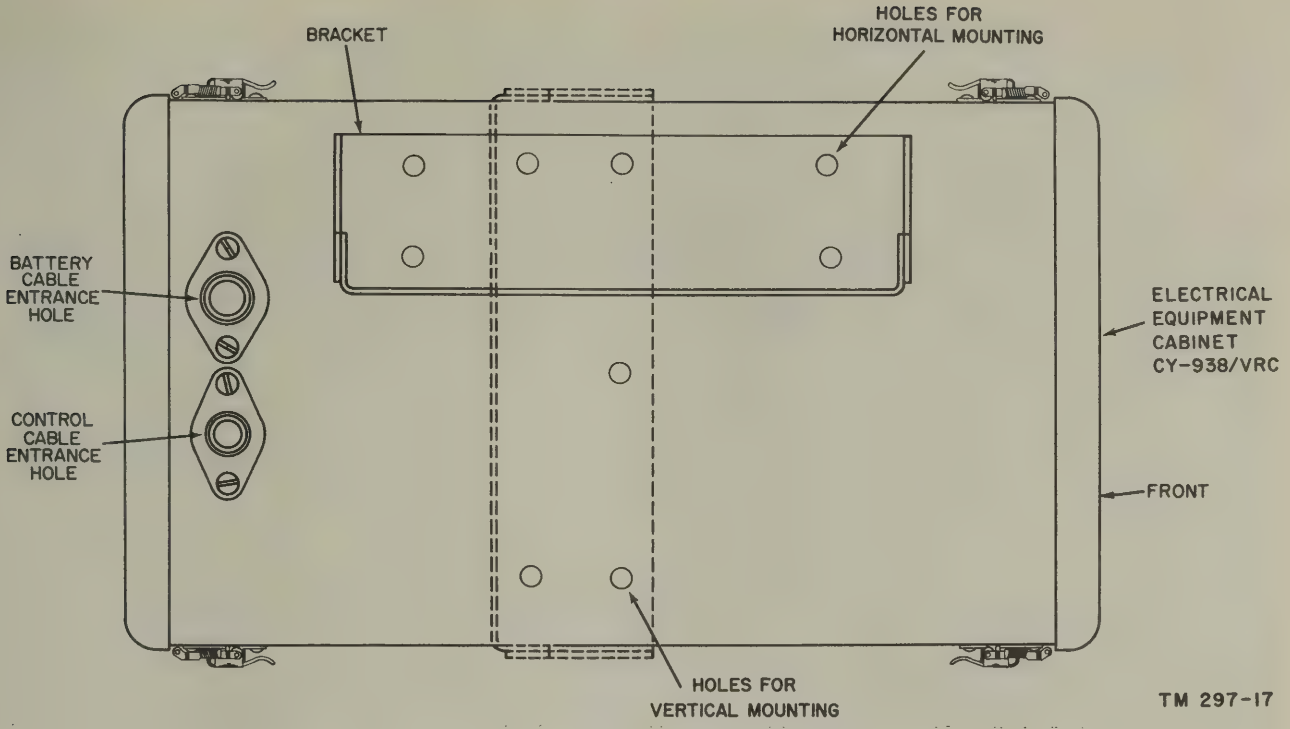

BRACKET
HOLES FOR HORIZONTAL MOUNTING
BATTERY CABLE ENTRANCE HOLE
CONTROL CABLE ENTRANCE HOLE
ELECTRICAL EQUIPMENT CABINET CY-938/VRC
FRONT
HOLES FOR VERTICAL MOUNTING
TM 297-17

Figure 19. Electrical equipment cabinet CY–938/VRC, mounting bracket installation.

horizontal or vertical position, depending on how the equipment cabinet is to be mounted (fig. 17). The correct bracket position for each method of mounting is shown in figure 19. Each bracket is held by five bolts that are screwed into the threaded holes in the sides of the equipment cabinet. After the brackets are attached, install and secure the equipment cabinet on the mounting rack with four bolts, one for each post of the mounting rack. The necessary bolts, nuts, and washers are supplied with the equipment cabinet.

d. Installation of Control Bracket. The control bracket (fig. 13) has three mounting holes that match three threaded holes on the side of the equipment cabinet. Fasten the control bracket on the equipment cabinet with 3 threaded bolts and 3 washers. The control bracket can be used for installing the control unit only when the equipment cabinet is mounted vertically. If horizontal mounting is used, the control bracket must be mounted on some other surface. If threaded mounting holes are not available on the surface selected, they must be drilled and tapped (threaded). Make a drawing of the exact spacing of the three holes in the control bracket (a template), and use it as a guide in spacing the holes to be drilled. When mounting the control bracket on a surface other than the equipment cabinet, place the bracket so that nothing will be in the way when attaching the control unit, and be sure that the location is within reach of the control cable.

e. Installation of Radio Set Control C–847/U. Remove the rear cover from the control unit by unscrewing the eight screws that hold it. Make the proper control cable connections before installing the unit on the equipment cabinet. Refer to the instructions given in paragraph 27 to make these connections. Replace the cover on the control unit, and place it flush against the control bracket so that the two flanges align with the studs on the bracket. Place washers over the studs; then secure the control unit with two nuts.

f. Installation of Handset Holder. The handset holder consists of an L-shaped bracket and a clip assembly, and is packed with the spare parts kit. The clip can be used separately or in conjunction with the bracket, depending on the installation. When using both parts, the clip is fastened to the bracket by means of two holes provided in the bracket. The clip or clip and bracket assembly can be mounted at any convenient location consistent with the length of the control cable.

g. Installation of Components in Electrical Equipment Cabinet CY–938(*)/VRC. Place the rear of the component to be installed on the rails

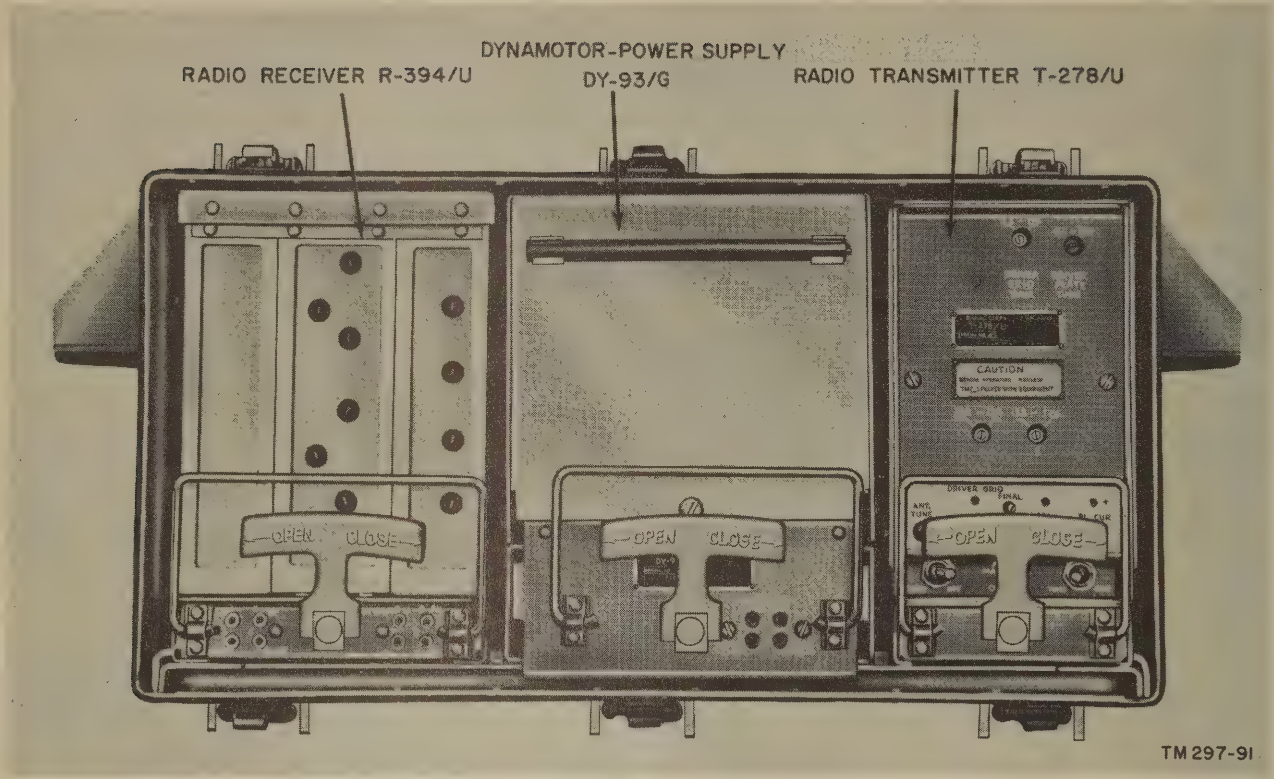


Figure 20. Electrical equipment cabinet CY–938/VRC, with components installed.

in the proper section of the equipment cabinet. Slide it into the equipment cabinet until the plug on the component and the jack in the cabinet are engaged. Secure it in place by turning the lock-in rod handle 360° in a clockwise direction. Place the handle in an upright position flush against the front panel of the component. After all components are installed, replace the front cover on the equipment cabinet. Figure 20 shows the components installed in the equipment cabinet.

h. Antenna Installation. The location of the antenna, in most cases, is determined by the type of vehicle. In general, the antenna should be placed as high as possible on the vehicle. Installation instructions depend on the type of antenna used and are contained in the individual antenna kits ordered through normal supply channels with the radio set.

27. Connections

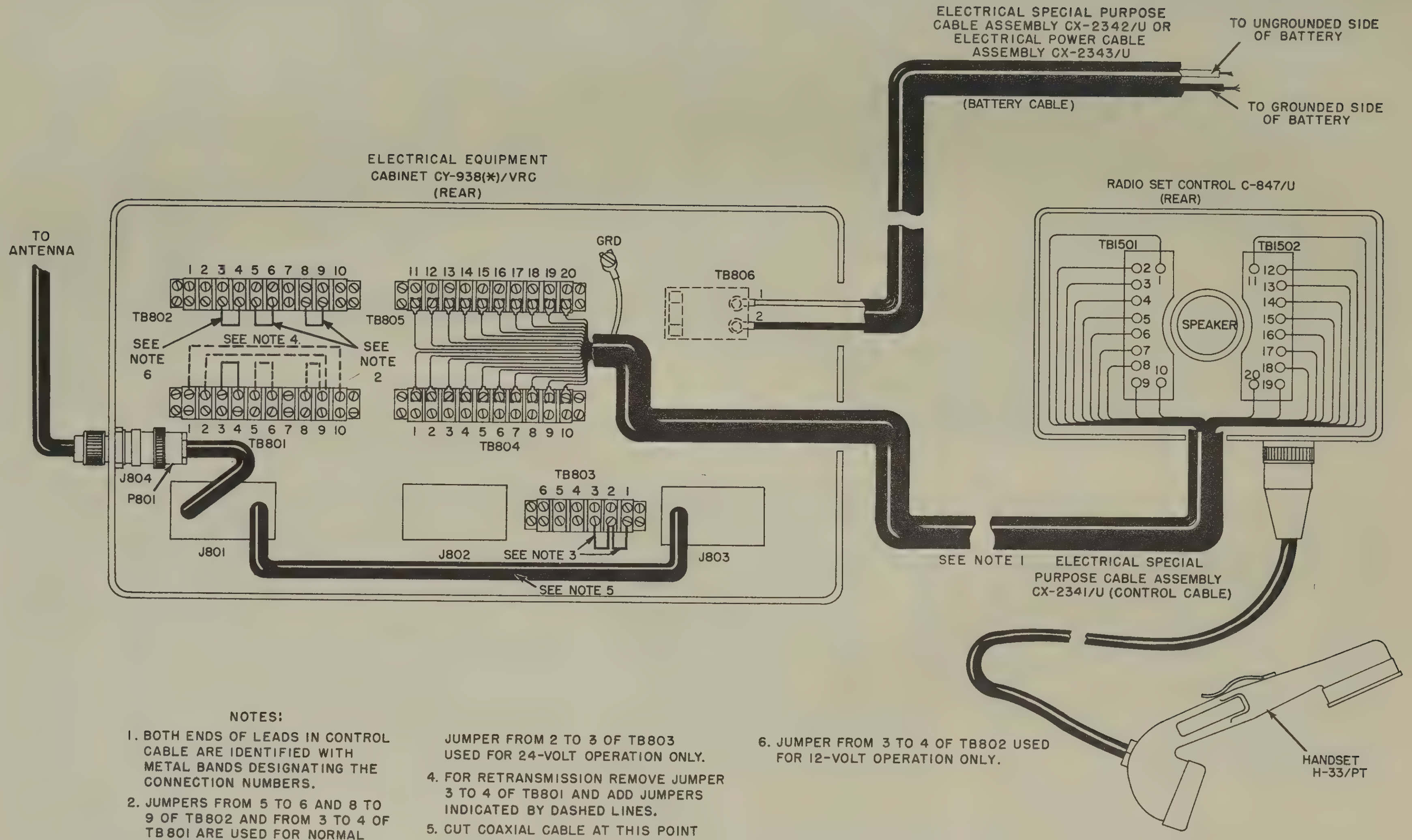
(fig. 21)

a. General. The method of mounting the equipment cabinet will affect to some extent the order in which the radio set is connected. The input cables from the power source are connected from the front with the receiver out of the equipment cabinet. All other connections are made with the rear cover removed. This means that connections can be made after installation *only* if both the front and the rear of the equipment cabinet can be reached. Refer to figure 21 for a cording diagram of all necessary connections.

b. Power Connections.

Caution: Do not connect cables to the primary power source (battery) until all other connections have been made. The battery cable has lugs on one end for connection to the radio set. They are to be connected in the following manner:

(1) Remove the front cover of the equipment cabinet.
(2) Remove the receiver.
(3) Feed the end of the battery cable with the lugs attached through the top cable hole at the rear left side of the equipment cabinet.
(4) Connect the leads to terminals 1 and 2 of terminal board TB806. The lead that will go to the ungrounded terminal of the battery must be connected to terminal 1 of TB806.


ELECTRICAL SPECIAL PURPOSE CABLE ASSEMBLY CX-2342/U OR ELECTRICAL POWER CABLE ASSEMBLY CX-2343/U
(BATTERY CABLE)
TO UNGROUNDED SIDE OF BATTERY
TO GROUNDED SIDE OF BATTERY
ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC (REAR)
RADIO SET CONTROL C-847/U (REAR)
TO ANTENNA
TB802
SEE NOTE 6
SEE NOTE 4.
SEE NOTE 2
TB801
TB805
TB804
GRD
TB806
1
2
J804
P801
J801
J802
J803
TB803
SEE NOTE 3
SEE NOTE 5
TB1501
TB1502
SPEAKER
SEE NOTE 1
ELECTRICAL SPECIAL PURPOSE CABLE ASSEMBLY CX-2341/U (CONTROL CABLE)
HANDSET H-33/PT
TM 297-92

NOTES:

1. BOTH ENDS OF LEADS IN CONTROL CABLE ARE IDENTIFIED WITH METAL BANDS DESIGNATING THE CONNECTION NUMBERS.
2. JUMPERS FROM 5 TO 6 AND 8 TO 9 OF TB802 AND FROM 3 TO 4 OF TB801 ARE USED FOR NORMAL OPERATION.
3. JUMPER FROM 1 TO 2 OF TB803 USED FOR 6-VOLT OPERATION ONLY. JUMPER FROM 2 TO 3 OF TB803 USED FOR 24-VOLT OPERATION ONLY.
4. FOR RETRANSMISSION REMOVE JUMPER 3 TO 4 OF TB801 AND ADD JUMPERS INDICATED BY DASHED LINES.
5. CUT COAXIAL CABLE AT THIS POINT WHEN USING SEPARATE RECEIVING AND TRANSMITTING ANTENNAS FOR RETRANSMISSION.
6. JUMPER FROM 3 TO 4 OF TB802 USED FOR 12-VOLT OPERATION ONLY.

Figure 21. Radio set AN/VRC–19(*), connections.

(5) Be sure that a good 50-ampere fuse is securely in place in the fuse holder.

Caution: Do not use a fuse rated above 50 amperes. The equipment might be damaged.

c. Jumper Connections. The radio set is designed to use either of three power sources. It is necessary, however, to make jumper connections at the rear of the equipment cabinet to adapt the set to the particular source being used. Remove the rear cover from the equipment cabinet and make the proper connections as indicated below.

(1) In Radio Set AN/VRC–19(*) (all models) place a jumper between terminals 3 and 4 of TB801, between terminals 5 and 6 of TB802, and between terminals 8 and 9 of TB802.

(2) In Radio Set AN/VRC–19Y (6-volt model), place a jumper between terminals 1 and 2 of TB803.

(3) In Radio Set AN/VRC–19X (12-volt model), place a jumper between terminals 3 and 4 of TB802.

(4) In Radio Set AN/VRC–19 (24-volt model), place a jumper between terminals 2 and 3 of TB803.

Note. It is possible to make the transmitter tube filaments operate continuously by connecting a jumper across two terminals in the transmitter power supply (fig. 47, 48, and 49). Refer to the transmitter power supply instruction book for connection details.

d. Control Connections. Remove the rear covers from the equipment cabinet and from the control unit. Feed the spade lug end of the control cable through the lower cable hole on the left-hand side of the equipment cabinet. Each wire of the cable is marked with a numbered metal tag. The numbers match terminal numbers of terminal boards TB804 and TB805. Connect each wire to its mating terminal on these boards. The heavy braided lead should be connected under the screw marked GND. Feed the other end of the cable, which has pin connectors, through the hole in the bottom of the control unit. The ends of these wires also are marked with numbered metal bands. Plug each pin connector into its mating jack on terminal boards TB1501 and TB1502 in the control unit. After making these connections, replace the rear covers on the control unit and the equipment cabinet.

Note. When only one crystal is available for Radio Transmitter T–278/U, place it in the frequency 1 crystal socket. Connect leads 5 and 6 of the control cable from the control unit to terminal 5 of TB804. This permits the transmitter to operate in either position of the frequency selector switch.

e. Retransmission Connections. It is necessary to make fairly extensive adjustments to the radio set when retransmission operation is required. A separate antenna must be used for the receiver, and retransmission relay K271 must be plugged into the receiver. Jumper connections in both the receiver and the equipment cabinet must be changed. These adjustments require a suitable receiving antenna, a suitable length of radio frequency cable, mating radio frequency cable connectors, and one Receiver Subassembly MX–1547/G. This equipment is not supplied with the radio set and must be ordered through normal supply channels. When the radio set is used as a retransmission unit, the unused power cable entrance hole in the equipment cabinet may be used as an entrance hole for the cable from the second antenna. To adjust the radio set for use as a retransmission unit, proceed as follows:

(1) Install the antenna supplied with the retransmission installation kit as a receiving antenna. Follow the instructions given in the installation kit.

(2) In the equipment cabinet, remove the jumper from terminals 3 and 4 of TB801 and connect jumpers between terminals 1 and 10, 2 and 9, 5 and 6, and 8 and 9 of TB801. Cut the coaxial cable between J801 and J803 at its midpoint and install one of the radio-frequency (rf) connectors to the end of the half connected to J803. Tape the exposed end of the other half.

(3) Install the other rf cable connector to one end of a suitable length of radio frequency cable, and connect it to the coaxial cable connected to J803. This length of cable should be long enough to reach to the receiving antenna. Attach the other end of the radio frequency cable to the newly installed receiving antenna.

(4) In the receiver, disconnect the end of the jumper connected to terminal 9 of TB251, and connect it to terminal 11 of TB251. Plug Receiver Subassembly MX–1547/G into the space provided.

f. Battery Connections. Be careful when connecting the power cable to the battery. Connect the grounded lead of the power cable (terminal 2 of TB806) to the grounded side of the battery. Connect the ungrounded lead of the power cable to the ungrounded side of the battery. Provision is made in Radio Set AN/VRC–19(*) to operate when either the positive or the negative terminal of the vehicle battery is grounded to the chassis. Polarity of the battery does not affect any of the components except the transmitter power supply. If the output of the transmitter power supply dynamotor is not of the correct polarity, a negative high voltage will be applied to the transmitter instead of a positive voltage. This can be corrected by reversing the output connections of the dynamotor. To do this, it is necessary to remove the transmitter power supply from the equipment cabinet, remove its top cover, and reverse the output plug connectors located at the rear of the dynamotor (fig. 30). After changing the polarity, replace the power supply. The polarity can be checked at the front panel of the power supply by placing a dc voltmeter across the terminals marked −25V and +380V (fig. 25) with the positive terminal of the meter at the +380V terminal. If the voltmeter reads in a positive direction, the polarity is correct. If the voltmeter reads in wrong direction (negative reading) the polarity of the power supply is incorrect, and the dynamotor output connections must be reversed.

28. Service Upon Receipt of Used or Reconditioned Equipment

a. Refer to the instructions given in paragraphs 9 and 25 when unpacking used or reconditioned equipment.

b. If used equipment is received for service, check for tags or other sources of information regarding the condition of the equipment. If the sources of information indicate changes in the wiring of the equipment, note the changes in this manual, preferably on the component schematic diagrams. When the condition of the equipment is doubtful and information is not available, perform the troubleshooting procedures described in paragraphs 72 through 87. A thoroughly reconditioned piece of equipment may be considered to be in the same condition as new equipment, and instructions for the operation of new equipment may be followed.

Section II. CONTROLS AND INSTRUMENTS

29. Controls and Their Uses

The controls used for normal operation after the radio set is installed and adjusted are located on the control unit. These controls are not complicated; however, an understanding of their functions will enable the operator to take advantage of the service that can be provided with proper control settings. The other controls and test points are located on the transmitter, transmitter power supply, and receiver. They are used mainly to check the radio set for proper operation, initial tuneup procedures, and maintenance procedures.

30. Radio Set Control C–847/U, Controls

(fig. 22)

Control	Function
VOLUME-OFF switch	Turns on the power to the radio set and controls the volume level to the handset and the speaker. Four volume levels are available.
SPKR switch	Connects the speaker in the ON position. In the OFF position, disconnect the speaker. The switch is spring-loaded and must be held in place when using the OFF position.
POWER indicator	Lights whenever the VOLUME switch is in any position but OFF; indicates that power is applied to the receiver.
TRANSMIT indicator	Lights when the push-to-talk switch on the handset is closed; indicates that the transmitter is in operation and the receiver is disabled.
SQUELCH control	Disables the receiver squelch circuit with the SQUELCH control in the OFF position. In other positions, the control sets the level of squelch operation.
FREQ 1–2 switch	Selects either of two preset transmitter frequencies.
HANDSET connector	Located on the bottom of the control unit, it connects the handset cable to the control unit, thereby connecting the handset to the necessary receiving and transmitting circuits.
Speaker	Enables the operator to hear incoming signals without having to hold the handset to his ear. This feature is necessary when the vehicle is in motion or when more than one person desires to listen.

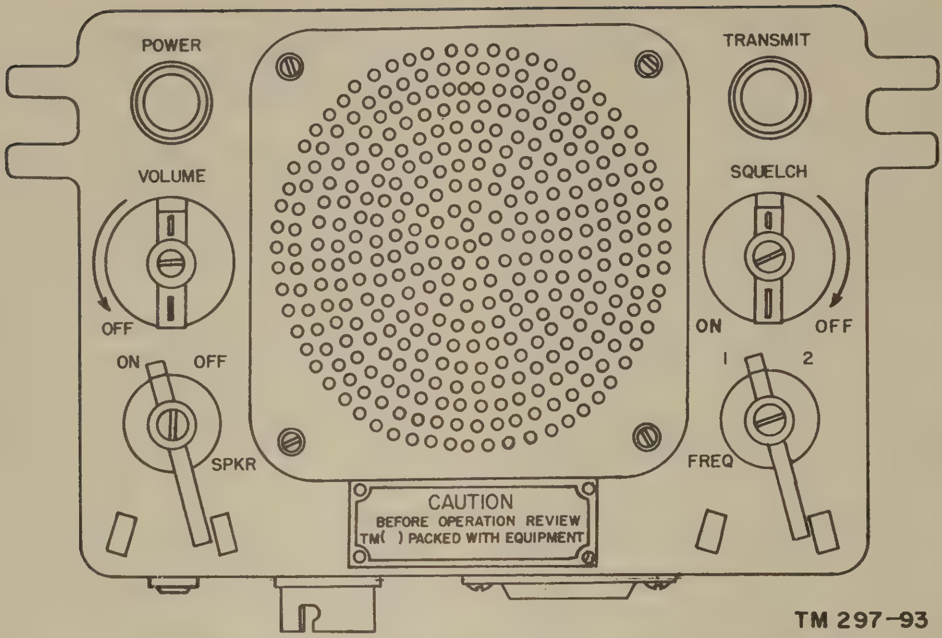


Figure 22. Radio set control C–847/U, front panel controls.

31. Radio Transmitter T–278/U, Controls
(fig. 23)

Control	Function
TEST-OFF switch	In the TEST position, it energizes a relay in the transmitter power supply which allows power to be supplied to the transmitter. In the OFF position, power is applied to the transmitter by operation of the push-to-talk switch on Handset H–33/PT.
TUNE-OPR switch	In the TUNE position, it reduces screen voltage applied to the fifth doubler and driver and the power-amplifier tubes. In the OPERATE position, it allows normal screen voltage to be applied to the fifth doubler and driver and the power-amplifier tubes.
DRIVER GRID TUNE control	Tunes the fifth doubler and driver grid tank circuit to the desired frequency.
DRIVER PLATE TUNE control	Tunes the fifth doubler and driver plate tank circuit to the desired frequency.
FINAL GRID TUNE 1 control	Tunes the grid tank circuit of power-amplifier tubes to the desired frequency.
FINAL GRID TUNE 2 control	Tunes the grid tank circuit of power-amplifier tubes to the desired frequency.
FINAL PLATE TUNE control	Tunes power-amplifier plate circuit to the desired frequency.
COUPLING MAX-MIN control	Varies the coupling between the power-amplifier plate lines and the output link.
ANT TUNE control	Adjusts the tuning of the antenna circuit.
DRIVER GRID jack	Test point for checking grid voltage of the fifth doubler and driver stage during tuning procedure.
FINAL GRID jack	Test point for checking grid voltage of the power amplifier during tuning procedure.
PL CURRENT jacks	Test points for checking plate current of the power-amplifier stage during tuning procedure.
DEVIATION LEVEL control (R452, not accessible from front panel).	Controls the amount of deviation of the transmitted signal.
FREQ 1 control (C403, not accessible from front panel).	Fine tuning adjustment of FREQ 1 oscillator V401.
FREQ 2 control (C404, not accessible from front panel).	Fine tuning adjustment of FREQ 2 oscillator V402.

32. Radio Receiver R–394/U, Test Points

(fig. 24)

Test point	Function
LO jack	Used to measure dc voltage at the control grid of first mixer tube V3.
RF jack	Used to measure dc voltage at the control grid of 7.8-mc if. amplifier tube V51.
1ST IF jack	Used to measure dc voltage at the control grid of first 455-kc if. amplifier tube V81.
2D IF jack	Used to measure dc voltage at the control grid of fifth 455-kc if. amplifier tube V85.
DISCR jack	Used to measure dc output of the discriminator circuit.
FIL jack	Used to check the 1.4-volt dc filament voltage.
B+ jack	Used to check the +145-volt dc plate supply voltage.
GND jack	Used as a common ground connection for external meter measurements.

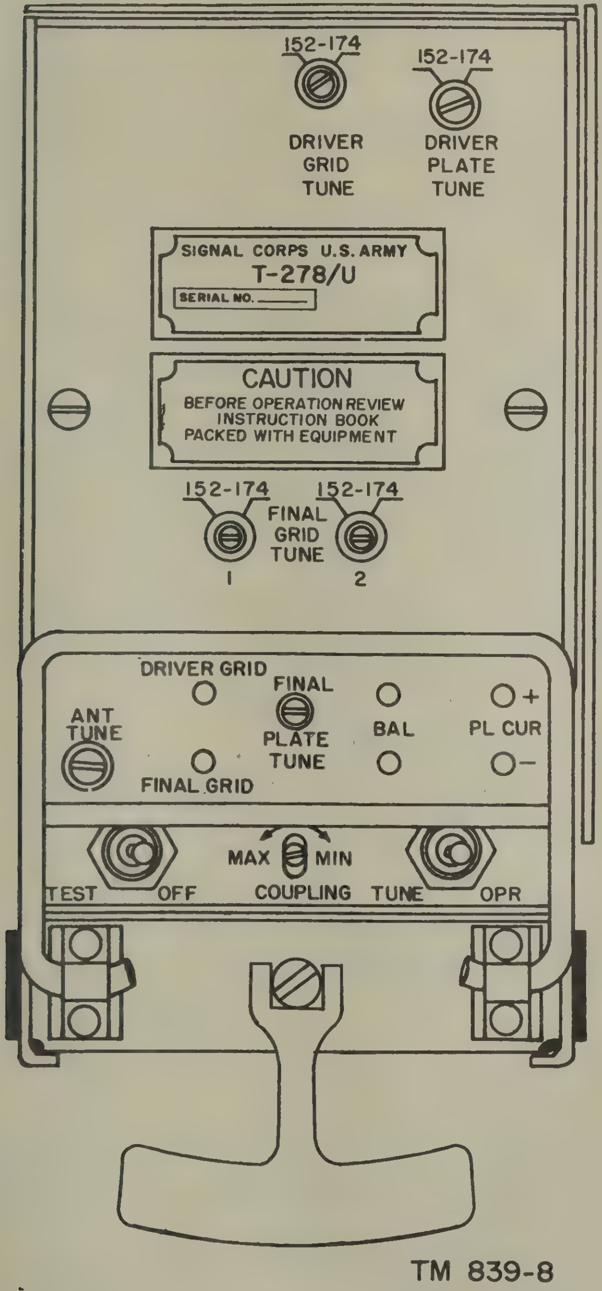


Figure 23. Radio transmitter T–278/U, front panel.

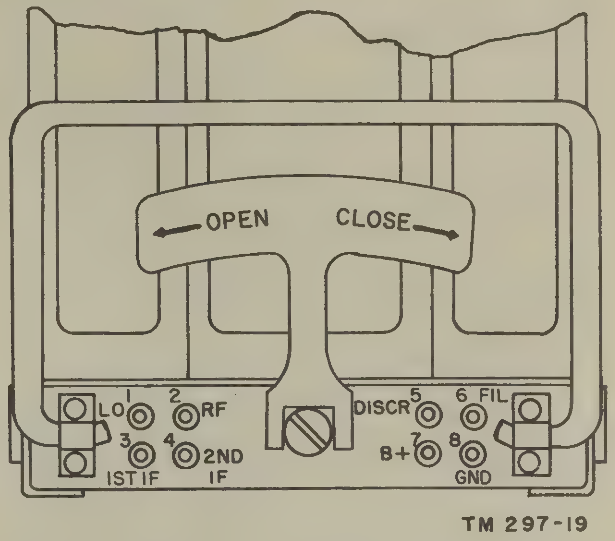


Figure 24. Radio receiver R–394/U, front panel test points.

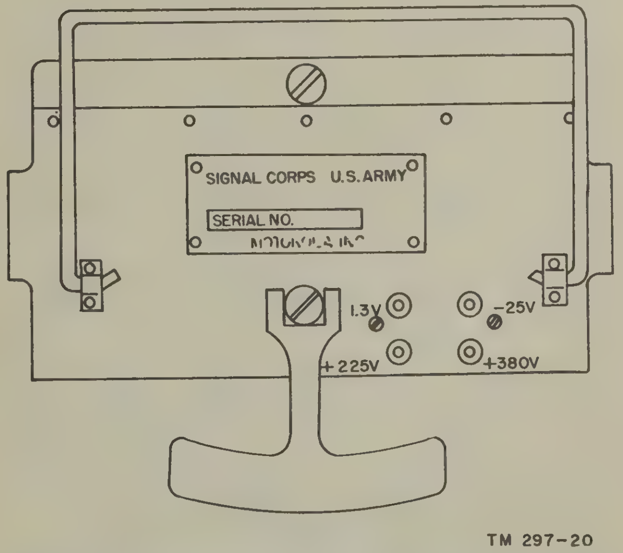


Figure 25. Typical transmitter power supply, front panel test points.

33. Transmitter Power Supply Test Points

(fig. 25)

Test point	Function
J1203 1.3V jack	Used to test 1.3-volt filament supply.
J1204 −25V jack	Used to test −25-volt bias supply.
J1205 +225V jack	Used to test +225-volt supply.
J1206 +380V jack	Used to test +380-volt supply.

Note. The test points listed in the chart above apply to Dynamotor-Power Supply DY-100/U. The jacks on Dynamotor-Power Supplies DY-93/G and DY-98/G are numbered in the 3,100 and 1,300 series, respectively.

Section III. OPERATION UNDER USUAL CONDITIONS

34. Initial Adjustment

a. Normally, Radio Set AN/VRC–19(*) operates at a frequency that is set up at the time of installation. The crystals that determine the operating frequency (Crystal Unit CR–32/U for the receiver and Crystal Unit CR–27/U for the transmitter) are not supplied with the radio set. The correct crystal frequencies depend on the operating frequency assigned to the radio set in its particular field use. When the operating frequency is known, the required crystal frequencies may be found by using the methods in paragraphs 85*a*(5) and 86*b*. The crystals then may be requisitioned through normal supply channels. It is possible to change both the receiving and transmitting frequencies as desired within a range of 152 to 174 mc. The two frequencies provided in the transmitter always must be within 1 mc of each other. Therefore, if one frequency is changed and the maximum separation is exceeded, the other frequency also must be changed. This is necessary because the transmitter will not operate efficiently when oscillator frequencies are too widely separated. There are three ways of accomplishing the changes in frequency, and each requires a different amount of skill. These methods are as follows:

(1) Replace both the receiver and transmitter with units which are tuned to the new frequency.

(2) Replace the receiver RF AMPL 152–174 MC and LOCAL OSC 152–174 MC plug-in units and the transmitter with units preset to the new frequencies.

(3) Retune the above plug-in units and the transmitter to the new frequencies.

b. The first two methods are not complicated and can be done by an operator without extensive radio experience. To remove the receiver and the transmitter from the equipment cabinet, turn the lock-in handles 360° in a counterclockwise direction, and pull the components forward and out. Replace them with units, tuned to the desired frequency. To change the receiver RF AMPL 152–174 MC and LOCAL OSC 152–174 MC plug-in units, release the latch at the rear of the receiver and remove the top cover. The plug-in units then may be pulled out and replaced.

c. Retuning the transmitter and the receiver plug-in units requires exact adjustments and a knowledge of the techniques used in the alinement of the receiver and transmitter. This method of changing frequencies should be attempted only by qualified radio repairmen. The alinement procedures are described in paragraphs 83 through 87; however, more details can be found on these procedures by referring to the instruction books for the specific units to be adjusted.

35. Starting Procedure

a. Preliminary. Set the controls on the control unit as follows:

Control	Position
SPKR switch	ON.
VOLUME-OFF switch	OFF.
FREQ 1–2 switch	1 or 2, depending on frequency desired.
SQUELCH control	OFF.

b. Starting. Rotate the VOLUME-OFF switch clockwise to the third position. The POWER lamp will light and a signal or noise will be heard from the handset or speaker within 15 or 20 seconds. If noise is not heard, or the lamp does not light, refer to the equipment performance check list (par. 55), to determine the reason. When indications are obtained that the receiver is in working order, further operation can be accomplished.

c. Squelch Adjustment. The squelch circuit quiets, or *squelches,* the noise output from the receiver when a signal is not being received. The receiver may be operated with or without squelch control. When the SQUELCH control is in the OFF position, the squelch circuit does not affect the receiver and sound can be heard in the speaker at all times. As it is turned towards the ON position (counterclockwise), the SQUELCH control opens a switch that allows the squelch circuit to quiet, or squelch, the receiver. At the same time it adjusts the level of signal required to unsquelch it. The control should be adjusted with the assistance of an operator at a station operating on the same frequency that is several miles away from the receiver. Adjust the control as follows:

(1) When a signal is not being received and just noise is heard from the receiver, turn the SQUELCH control counterclockwise until the noise no longer is heard.

(2) Request the operator of the assisting station to transmit a signal. The signal should unsquelch the receiver during the period of transmission and allow normal reception.

(3) Request the operator of the assisting station to stop transmitting. The receiver should squelch (quiet) as soon as the carrier no longer is received.

(4) If the receiver will not squelch, advance the SQUELCH control further. If the noise level is high and the signal level is low, it may be impossible to use squelch operation. Under these conditions, reception can be carried on with the SQUELCH control in the OFF position. The speaker and handset then will operate continuously during reception.

36. Push-to-talk Operation

a. General. For push-to-talk operation, it is only necessary to press the push-to-talk switch on Handset H–33/PT and speak into the handset microphone. When the switch is released, the transmitter is turned off automatically and the receiver is allowed to function. The volume to the handset and speaker can be regulated by setting the VOLUME-OFF switch to a position between OFF and full volume. The speaker is on at all times unless the SPKR switch is held in the OFF position. The operation of the handset is the same as that of a conventional telephone except for the use of the switch for transmission. The transmission frequency can be changed by a preset amount by placing the FREQ 1–2 switch in the alternate position.

b. Antijamming Procedures. Radio Receiver R–394/U has fixed frequency design characteristics, and the frequency cannot be varied without considerable trouble. There is, therefore, little choice as to procedure in overcoming any type of jamming action. When the receiver is jammed by an enemy signal, follow the procedure in the order indicated below, if possible, until signal read-through is established.

(1) Place the SQUELCH control in the OFF position. Some read-through may result.

(2) Advance the VOLUME-OFF control to maximum volume. A strong jamming signal may overload the speaker and permit some degree of read-through.

(3) Change the direction, position, and height of the antenna. These changes may have a favorable read-through effect on the desired signal.

(4) If the antenna is vertical, try it at various angles until it is horizontal. If it is horizontal, try it at various angles until it is vertical.

(5) Place the antenna so that some object such as a tree, tank, jeep, etc., is between it and the source of jamming. This may reduce greatly the strength of the jamming signal.

(6) If facilities for changing frequency are available, request a change in frequency and call sign.

(7) If the jamming action is so complete and effective that alternate frequencies do not permit communication, use some other means of getting the message through.

(8) Continue to operate. This will keep the enemy uncertain as to his jamming success, and he will probably not move to another frequency. His equipment will be tied down to what he believes is an active frequency.

37. Retransmission Operation

It is possible to receive a signal at the receiver and retransmit that same signal on another frequency. To do this, the audio output of the receiver must be fed into the audio input of the transmitter by making certain jumper connections in the equipment cabinet and the receiver as described in paragraph 27. Relay K271 also must be plugged into the receiver (par. 27). After the connections have been made, the starting procedure in paragraph 35 should be followed. During retransmission operation, the receiver and transmitter operate only when a signal is being received. The squelch circuit must be used during retransmission operation, because it controls the operation of the transmitter. If the squelch circuit is not used the transmitter will operate continuously. The speaker on the control unit will monitor the receiver audio output. The handset may be disconnected from the control unit, if it is not necessary to break in to the message being retransmitted.

38. Stopping Procedure

To remove all power from the radio set, turn the VOLUME-OFF control fully counterclockwise to the OFF position. No further control settings are necessary.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

39. General

The operation of Radio Set AN/VRC–19(*) may be difficult in regions where extreme cold, heat, humidity and moisture, and sand conditions prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

40. Operations in Arctic Climates

Subzero temperatures and conditions in cold climates affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry if possible.

c. Always take precaution to prevent cold air from coming into contact with heated tubes. A sudden draft of cold air is often sufficient to shatter the glass envelope of a heated tube.

d. Heavy coatings of frost will gather on mouth-type microphones in extreme cold weather when the handset is used in the open air. The operator's breath will cause frost to form in the small holes of the cap; this will affect transmitter modulation. Rubber and fabric diaphragms have been designed to protect some types of handsets; use them when available. Have a spare handset ready, if possible. The one in use may fail to function properly because of the above conditions.

41. Operation in Tropical Climates

When operating equipment in tropical climates, high humidity will cause condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the surrounding air. Dry the equipment thoroughly before operating it.

42. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same procedure to insure proper operation of the equipment.

b. The main problem arising with equipment operation in desert areas is the large amount of sand or dust that enters the moving parts of radio equipment. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks. Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt coming into contact with oil and grease will result in grit, and will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT AND PREVENTIVE MAINTENANCE SERVICES

43. Tools and Materials Issued for Radio Set AN/VRC-19(*)

A special alinement tool is the only tool issued with the radio set. Other materials that are useful when troubleshooting, but are not supplied with the radio set, are Tool Equipment TE-41 and Electrical Special Purpose Cable Assembly CX2371/U. These may be ordered through normal supply channels.

a. Tool Equipment TE-41 is a tool kit that contains adequate equipment for repairing the radio set.

b. Electrical Special Purpose Cable Assembly CX-2371/U is used to connect the receiver, transmitter, or transmitter power supply to the equipment cabinet when it is necessary to operate one of them outside of the equipment cabinet. The cable, known as a patch cord, is 4 feet long and has a male connector on one end and a female connector on the other end (fig. 26). It is useful when making internal adjustments and measurements under operating conditions.

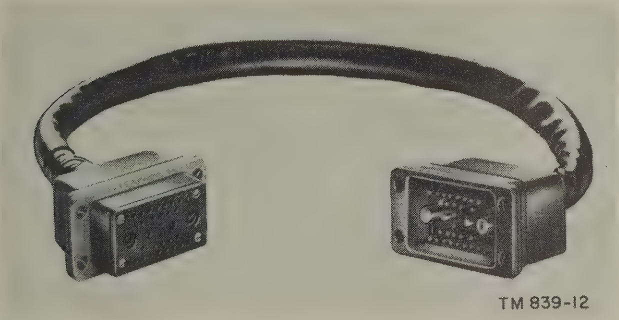


Figure 26. Electrical special purpose cable assembly CX-2371/U (patch cord)

44. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair in that its object is to prevent certain troubles from occurring. See AR 750-5, Maintenance of Supplies and Equipment, Maintenance Responsibilities and Shop Operation.

45. General Preventive Maintenance Techniques

a. Use No. 000 sandpaper to remove corrosion. Never use steel wool.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

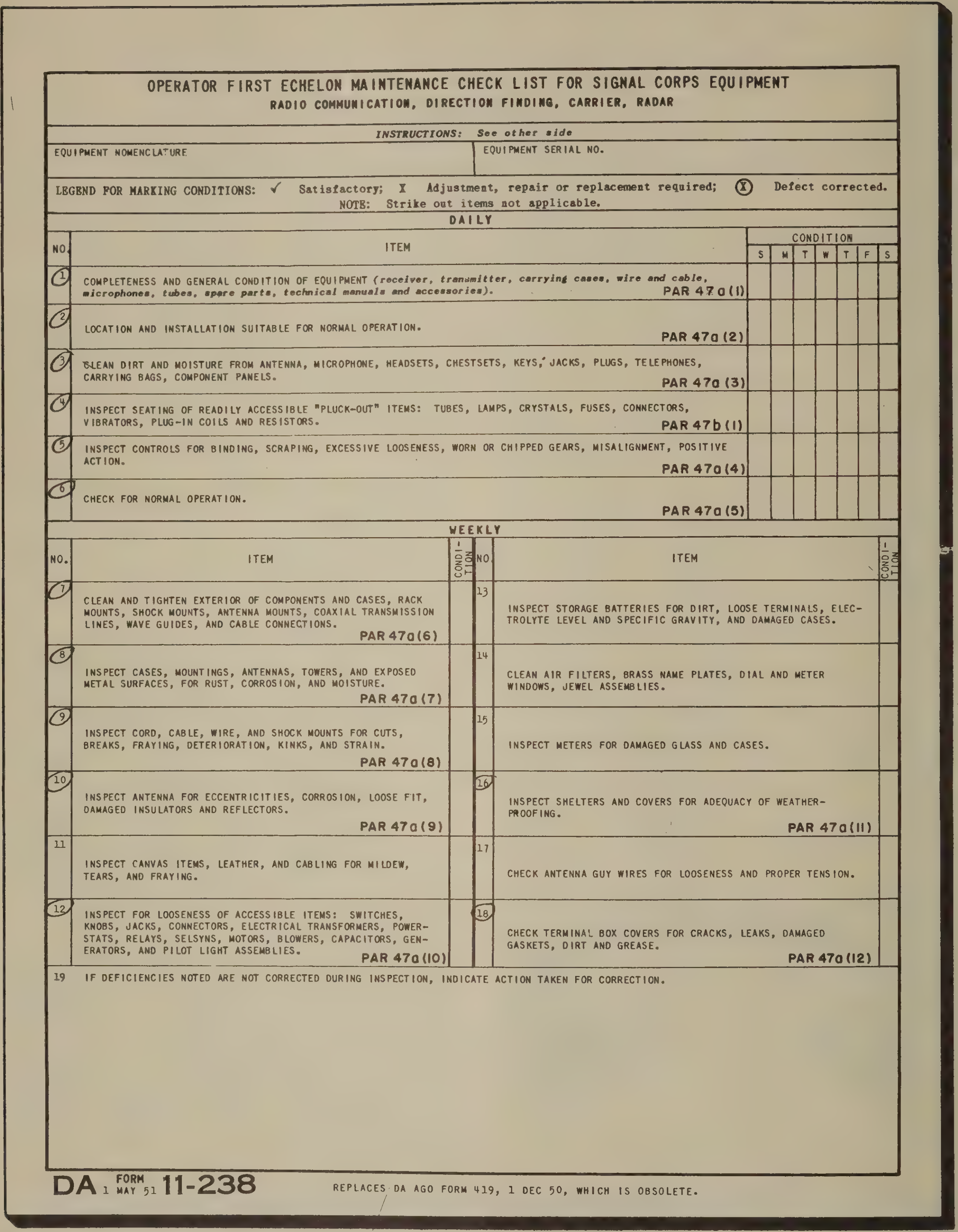
Caution: Repeated contact of carbon tetrachloride with the skin, or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result. Do not use compressed air near speakers or meter movements.

d. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

46. Use of Preventive Maintenance Form (fig. 27)

a. The decision as to which items on DA Form 11-238 are applicable to this equipment is a



OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.

NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION						
		S	M	T	W	T	F	S
[✓ 1]	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR 47a(1)							
[✓ 2]	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR 47a (2)							
[✓ 3]	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR 47a (3)							
[✓ 4]	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR 47b (1)							
[✓ 5]	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR 47a(4)							
[✓ 6]	CHECK FOR NORMAL OPERATION. PAR 47a (5)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
[✓ 7]	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR 47a (6)		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
[✓ 8]	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR 47a (7)		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	
[✓ 9]	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR 47a (8)		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
[✓ 10]	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR 47a (9)		[✓ 16]	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR 47a (11)	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
[✓ 12]	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR 47a (10)		[✓ 18]	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. PAR 47a (12)	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 **11-238** REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 297-124

Figure 27. DA Form 11-238.

tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of the form appear on the reverse side of the form.

b. Circled items in figure 27 are partially or totally applicable to Radio Set AN/VRC–19(*). References in the ITEM block refer to paragraphs in text that contain additional maintenance information.

47. Performing Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed may become damaged or broken.

a. Performing Exterior Preventive Maintenance.

(1) Check for completeness and satisfactory condition of the radio set. The components of the radio set are listed in the chart in paragraph 10 and are illustrated in figure 4.

(2) Check the radio set components to see that they are placed properly and have not shifted since installation.

(3) Remove dirt and moisture from the antenna, handset, control unit, and equipment cabinet (fig. 4).

(4) Check the controls for binding, scraping, excessive looseness, misalignment, and positive action (fig. 8).

(5) Check the operation of the radio set for satisfactory reception and transmission (pars. 34, 35, and 36).

(6) Check the mounting brackets, mounting rack, shock mounts, control unit, control bracket, battery cable connections, and antenna cable connections for looseness or defects.

(7) Inspect the exterior of the equipment cabinet, control unit, and mounting rack for signs of rust, corrosion, moisture, and chipped paint.

(8) Inspect the cables for cuts, breaks, fraying, deterioration, kinks, and strain (fig. 21).

(9) Inspect the antenna for bent or otherwise damaged parts.

(10) Inspect the pilot light jewels for dirt or cracked lenses (fig. 8).

(11) Inspect the covers of the control unit and the equipment cabinet for adequacy of weatherproofing.

(12) Inspect the rubber gaskets at the wire entrance holes in the equipment cabinet and the control unit for deterioration or leaks (figs. 5 and 8).

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

b. Performing Interior Preventive Maintenance.

Note. To gain access to the interior of the equipment cabinet, remove both covers by unfastening the trunk-type latches. If the equipment cabinet is mounted in the vertical position, remove it from the mounting rack before removing the rear cover.

(1) Remove each component and check the tubes, fuses, vibrators, crystals, plug-in capacitors, and connectors for proper seating (figs. 28 through 32).

(2) Inspect the cable lacing for rotted, frayed, or torn sections.

(3) Inspect the switches, knobs, jacks, transformers, chokes, dynamotor, filters, and relays for looseness.

(4) Check all tubes for loose envelopes, cap connections, and insufficient socket tension. Carefully remove all dust and dirt. Check emission of all tubes that can be tested.

(5) Inspect the fixed capacitors for leaks, bulges, and discoloration.

(6) Check the variable trimmer capacitors for dirt, moisture, misalignment of plates, and loose mountings.

(7) Inspect the resistors, bushings and insulators for cracks, chipping, blistering, discoloration, and moisture.

(8) Inspect the large fixed capacitors and resistors for corrosion, dirt, and loose contacts.

(9) Clean and tighten loose switches, terminal blocks, and interior sections of the chassis and the equipment cabinet.

(10) Inspect the terminal blocks for loose connections, cracks, and breaks.

(11) Inspect the dynamotor for brush wear, spring tension, arcing, and pitting of the commutator.

(12) Clean and tighten connections and mountings for transformers, chokes, potentiometers, and rheostats.

(13) Inspect the transformers, chokes, potentiometers, and rheostats for overheating and leakage.

(14) Inspect the gaskets inside the equipment cabinet and control unit covers to be sure they are waterproof.

(15) Check the loudspeaker for tears in the cone or a bent frame (fig. 50).

(16) Check for adequacy of moistureproofing and fungiproofing (pars. 49 and 50).

Section II. LUBRICATION AND WEATHERPROOFING

48. Lubrication

All lubrication points are supplied with a sufficient amount of grease or oil at the factory to last for the life of the equipment. Under normal conditions no other lubrication is necessary.

49. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperature are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, and TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment, and TB SIG 219, Operation of Signal Equipment at Low Temperatures.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

50. Rustproofing and Painting

a. When the finish on the equipment cabinet has been badly scarred or damaged, rust and corrosion can be prevented by touching up bare surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the equipment cabinet and cause harmful internal shorting or grounding of circuits.

b. When a touchup job is necessary, apply paint with a small brush. Remove rust from the equipment cabinet by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. Refer to TM 9–2851, Painting Instructions for Field Use

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

51. General

a. The troubleshooting and repairs that can be performed at the organizational maintenance level (operators and repairmen) are necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such trouble as burned-out tubes, fuses, etc.

b. The following paragraphs in this section will help to determine which component, such as the receiver or transmitter, is at fault. After localizing the fault to a component, the defective stage or item can be determined by following the instructions given in the particular component manual.

52. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one or more of the following faults.

(1) Improperly connected battery cable.

(2) Worn, broken, or improperly connected cords or plugs.

(3) Burned-out fuse.

(4) Relay contacts burned because of overloads.

(5) Wires broken because of excessive vibration.

(6) Defective tube.

(7) Inactive (dirty or cracked) crystal.

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the system. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

c. Visually inspect the antenna system for obvious abnormalities.

53. System Sectionalization of Trouble to a Component

System sectionalization consists of determining whether the trouble is in the receiver, equipment cabinet, transmitter, control unit, or power supplies.

a. Operate the entire set and observe its performance. See the equipment performance check list (par. 55) for normal operating indications.

b. If the entire radio set is inoperative, and the POWER lamp on the radio set control does not light, the trouble is probably in the primary power source. Worn-out batteries, broken wiring, and burned-out fuses are common primary power source troubles. The primary power circuit extends through fuse F801 and wiring in the equipment cabinet, through a fuse and wiring in the transmitting power supply, through the power switch in the control unit, and back to the transmitter power supply (figs. 47, 48, and 49).

c. If only one component is inoperative, first check for a burned-out fuse. Check fuses at an early stage in troubleshooting. Do not continue to burn out fuses before checking further to determine the source of the trouble.

d. If extra components in operating condition are available, the defective component may be located by substituting a serviceable component for the one suspected of being at fault. If the trouble disappears, the exchanged component may be assumed to be defective.

e. To determine whether excessive receiver noise is due to internal conditions or external conditions, disconnect the antenna. If noise becomes less pronounced or stops, the fault is not in the receiver. If noise persists after the antenna is disconnected, the trouble *is* in the receiver or in one of the components associated with it.

f. Use procedures similar to the simple checks given above to isolate the trouble to a particular unit.

g. If these checks are not productive, refer to the equipment performance check list (par. 55).

54. Troubleshooting by Using Equipment Performance Check List

a. *General*. The equipment performance check list (par. 55) will help the operator locate trouble in the equipment. The chart gives the items to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures that the operator can take. *When using this chart, follow the items in numerical sequence.*

b. *Action or Condition*. For some items, the information given in the *Action or condition* column consists of various switch and control settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the *Normal indications* column.

c. *Normal Indications*. The normal indications listed include signs that the operator can see and hear when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. *Corrective Measures*. The corrective measures listed indicate some of the causes of abnormal indications. In many cases the operator may correct the trouble without turning in the equipment for repairs. Other paragraphs and technical manuals are given as references for further information. Where these references are listed, it generally indicates that the operator probably cannot correct the trouble and that troubleshooting by an experienced repairman is necessary.

Note. Refer to figures 28 through 32 for the locations of tubes, fuses, vibrators, and check points.

55. Equipment Performance Check List

	Item No.	Unit	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Radio Transmitter T-278/U.	TEST-OFF switch	Set to OFF		
	2		TUNE-OPERATE switch.	Set to OPERATE		
	3	Electrical Equipment Cabinet CY-938*/VRC.	Battery cable	Connected between TB806 and battery.		
	4	do	Antenna cable	Connected between antenna connector J804 on the equipment cabinet and the antenna base connector.		
	5	do	Control cable (20-wire).	Connected from TB804 and TB805 to control unit.		
	6	Radio Set Control C-847/U.	Control cable (20-wire)	Connected from TB1501 and TB1502 to the equipment cabinet.		
	7	do	Handset cable	Connected to HANDSET jack.		
	8	do	VOLUME-OFF switch	Rotate to OFF		
	9	do	FREQ 1-2 switch	Set to 1 or 2, depending on frequency desired.		
	10	do	SQUELCH control	Rotate to OFF		

START	11	Radio Set Control C–847/U.	VOLUME-OFF switch	Set to a position other than OFF.	POWER indicator lamp lights	Check fuse F801. Check battery cable connection for poor contacts. Check control cable for defect or poor connection. Check for a defective VOLUME-OFF switch in the control unit. Check for a defective POWER indicator lamp. Check for a defective fuse in the receiver power supply or the transmitter power supply.
					A signal or noise is heard in the speaker or handset.	Check for a defective fuse in the receiver power supply. Check the connections at terminals 11 and 12 of terminal boards TB1502 and TB805 in the control unit and equipment cabinet, respectively. Check receiver connection to equipment cabinet. Refer to receiver instruction book.

Item No.	Unit	Item	Action or condition	Normal indications	Corrective measures
12	Radio Set Control C-847/U.	SQUELCH control	Turn counterclockwise	Without a signal, noise can be heard as the control is advanced until a certain point is reached, then the speaker and handset are quieted.	Check for a defective audio and squelch plug-in unit in the receiver. Check for a defective SQUELCH control or disabling switch. Check for improper or poor connections tween the receiver, control unit, and equipment cabinet. Refer to reciver instruction book.
				An incoming signal on the receiver frequency can be heard in the speaker and handset.	Check the antenna. Check for improper setting of SQUELCH control. Refer to receiver instruction book.
13	Handset	Push-to-talk switch	Depress switch	TRANSMIT indicator lamp lights.	Check for a poor handset connection or switch. Check for defective transmitter power supply. Check for an incorrect or a faulty connection in the equipment cabinet or in the control unit.
				The receiver is disabled	Check the SQUELCH control. If in the OFF position turn it counterclockwise. Check jumper connections between terminals 3 and 4 or terminal board TB801 in the equipment cabinet. Refer to receiver and transmitter instruction books.
				The transmitter power supply dynamotor can be heard.	Defective fuse F1301 in transmitter power supply (24-volt model). Refer to transmitter power supply instruction book.
			Release switch	A signal or noise (if the SQUELCH control is turned clockwise) is heard in the handset or speaker.	Same as for second normal indication in item No. 12.
14	Radio Set Control C-847/U.	FREQ 1-2 switch	Change to the other frequency.	The transmitted signal will be at a different frequency (check with appropriate receiving station).	Check for a defective or wrong crystal in the transmitter. Check for a defective oscillator tube in the transmitter. Refer to the transmitter instruction book.
15	do	SPKR switch	Turn to OFF position	Speaker will be inoperative, handset will operate.	Check for defective speaker switch or switch wiring.

STOP	16	Handset H–33/PT	Push-to-talk switch	Release switch	Transmitter is disabled	Check for defective switch.
					TRANSMIT indicator lamp goes out.	Check for defective wiring or connections in equipment cabinet. Check for a sticking relay in the transmitter power supply. Refer to the transmitter power supply instruction book.
	17	Radio Set Control C–847/U.	VOLUME-OFF switch	Turn counterclockwise to the OFF position.	POWER indicator lamp goes out.	Check for incorrect wiring, a defective switch, or relay. Refer to component instruction books.
					Receiver is inoperative	Same as above.
					Transmitter is inoperative	Same as above.

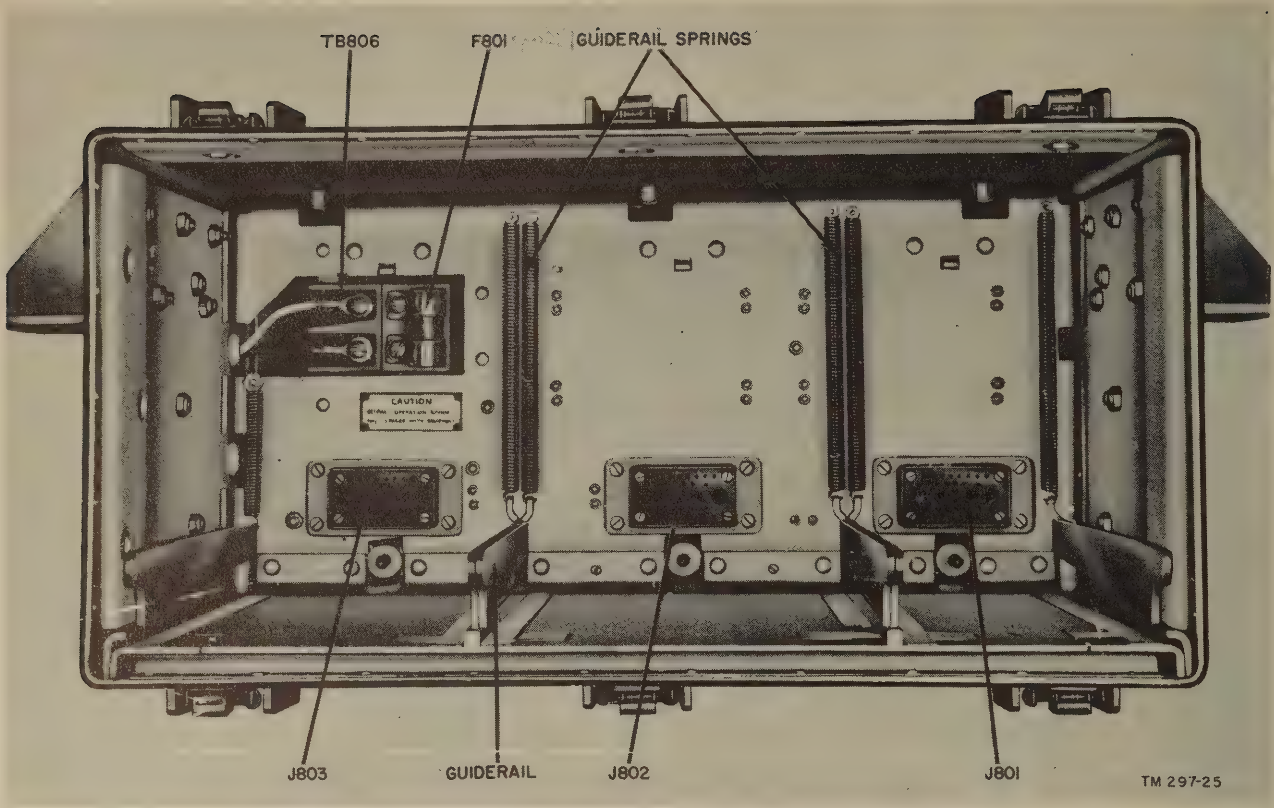


Figure 28. Electrical equipment cabinet CY–938/VRC, interior view.

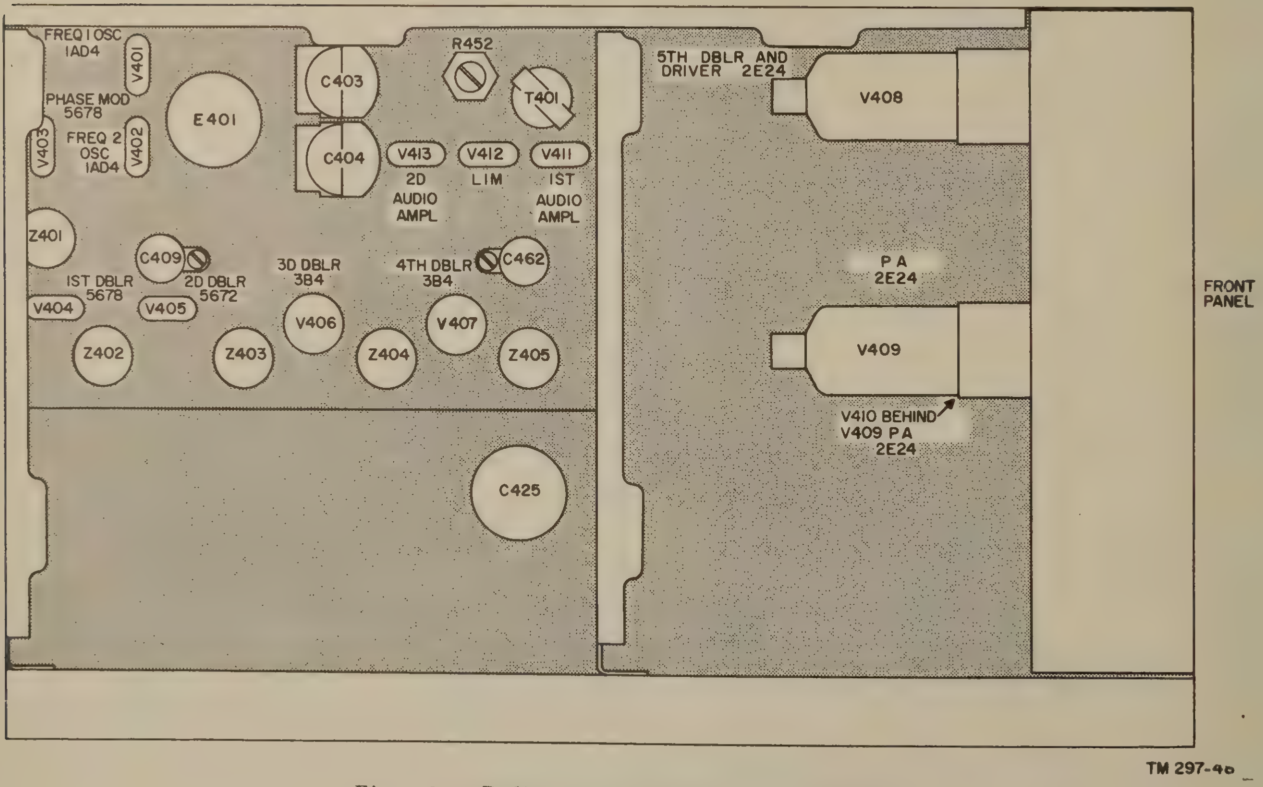


Figure 29. Radio transmitter T–278/U, tube location.

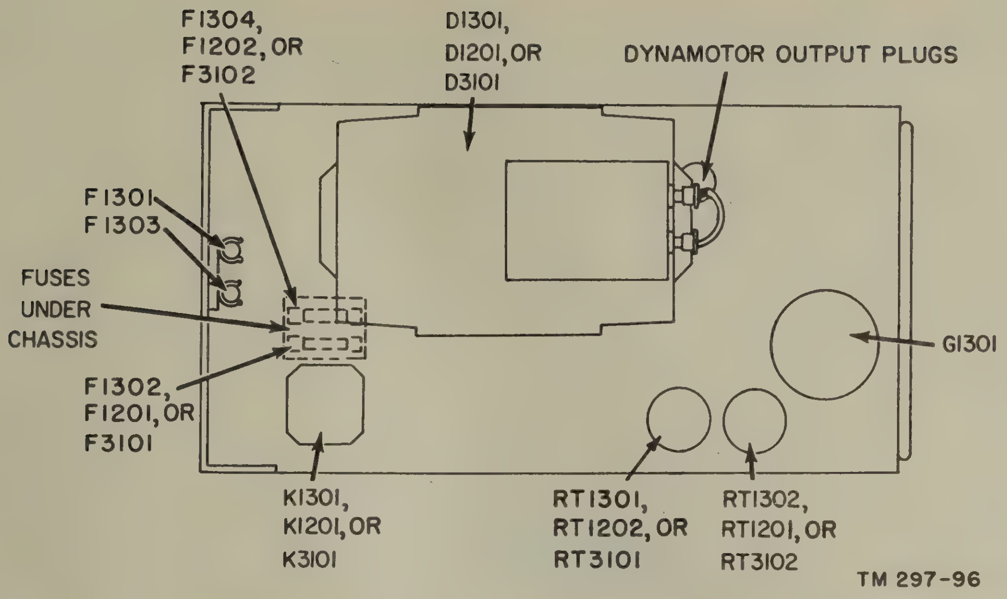


Figure 30. Transmitter power supply fuse, relay, regulator, and vibrator location.

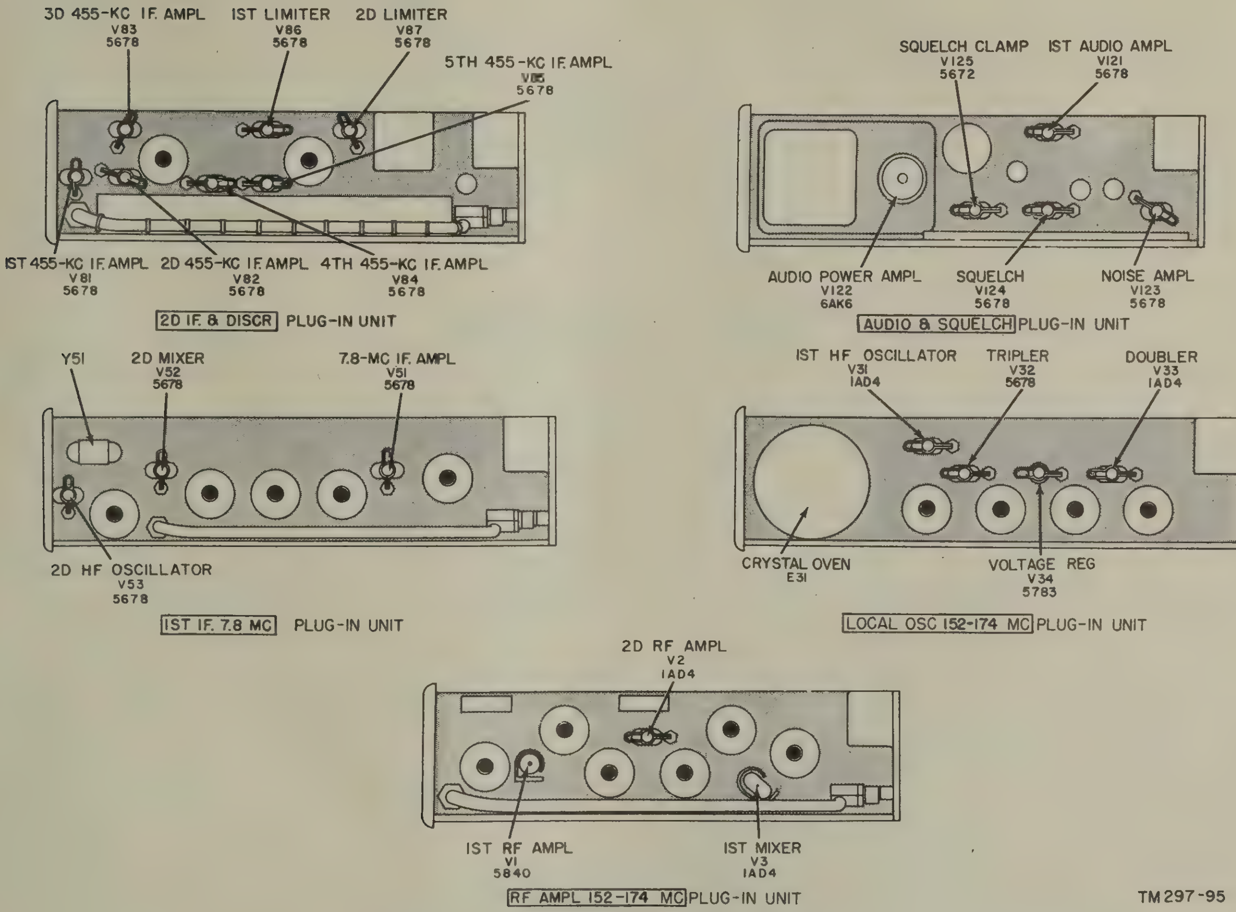


Figure 31. Radio Receiver R–394/U, tube location.

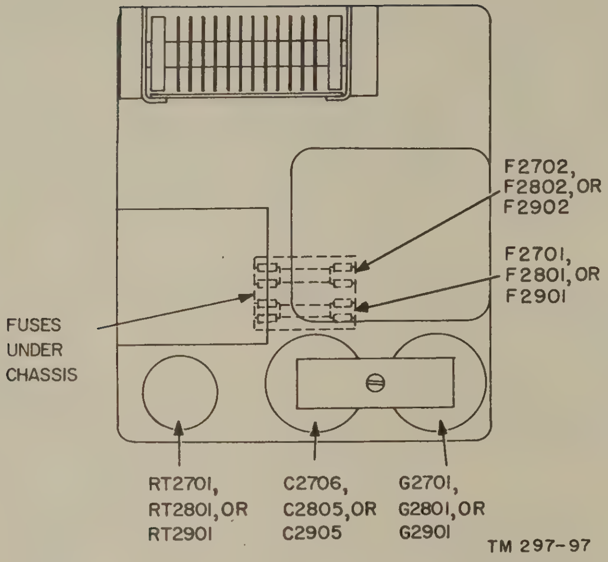


Figure 32. Receiver power supply fuse and vibrator location.

CHAPTER 4

THEORY

56. General

a. System theory is presented to provide an understanding of how the several units contained in the radio set function together to provide a complete system (par. 57). An understanding of the functioning of the complete system will aid in isolating troubles to a particular unit.

b. To familiarize personnel with the circuits contained in the transmitter, receiver, and power supplies, block diagrams of these units are described briefly in paragraphs 58 through 63. The detailed theory for each of these units is described in separate publications. Detailed theory for the control unit and equipment cabinet is described in this chapter (pars. 64 and 65).

57. System Theory

(fig. 2)

a. The circuits of Radio Set AN/VRC–19(*) are built around Radio Transmitter T–278/U and Radio Receiver R–394/U. These components are plug-in units and require the use of Electrical Equipment Cabinet CY–938(*)/VRC that serves as a container for the components and has facilities for interconnecting the components. Since the system must be capable of operating from a 24-, 12-, or 6-volt source of Radio Sets AN/VRC–19, –19X, and –19Y, respectively, individual plug-in power supplies are used for both the receiver and transmitter. The receiver power supply is contained within the receiver. The transmitter power supply is mounted outside the transmitter. When the system is changed from one voltage source to another, the power supplies also must be changed.

b. The receiver and the transmitter operate in the frequency range of 152 to 174 mc. Both use the same antenna that may be switched from one to the other by a coaxial type relay. For simplicity of operation, the radio set was designed to have a minimum number of controls used by the operator. These controls are located on the control unit.

58. Block Diagram of Radio Transmitter T–278/U

A block diagram of the transmitter is shown in figure 33. For more detailed overall circuit information, refer to the main schematic (fig. 68) and the transmitter instruction book. The signal paths through the transmitter are described below.

a. Frequency 1 and Frequency 2 Oscillators. Two crystal-controlled oscillator stages, tubes V401 and V402, allow quick changing between two preset operating frequencies. The oscillator to be used is selected by the FREQ 1–2 switch on the control unit. The switch allows filament voltage to be supplied to one stage and to be removed from the other. A frequency of 4.75 to 5.4375 mc, depending on the crystal used, is developed in either oscillator and fed to phase modulator V403.

b. Phase Modulator. In addition to the rf signal from the oscillator, an audio signal from tube V413 also is applied to phase modulator tube V403. This combination of audio and rf signals applied to the modulator produces an fm signal in the modulator output circuit which varies 468.75 cycles on each side of the oscillator resting (no audio signal) frequency for 100 percent modulation. The output of the modulator is applied to first doubler V404.

c. First, Second, Third, and Fourth Doublers, and Fifth Doubler and Driver. These stages are frequency multipliers. They are necessary to increase the modulator deviation and crystal frequency. The first, second, third, and fourth doublers and fifth doubler and driver operate at 2, 4, 8, and 16, and 32 times the crystal frequency, respectively, and produce deviations of 937.5, 1,875, 3,750, 7,500, and 15,000 cycles, respectively. The fifth doubler and driver also serve as a driver stage for the power amplifier. Its output is coupled to the power amplifier stage.

d. Power Amplifier. The power amplifier consists of two type 2E24 tubes, V409 and V410, connected as push-pull amplifiers. They are mounted on a subchassis with the fifth doubler and driver. The output of the power amplifier is coupled to the antenna through an antenna filter in the antenna circuit. This filter is used to reduce harmonic emission.

e. First Audio Amplifier. Audio signals from the microphone of the handset or from the receiver (during retransmission) are applied to the control grid of first audio amplifier V411. The amplified audio signals at the output of this stage are coupled to the control grid of the limiter tube.

f. Limiter. Limiter tube V412 limits the magnitude of strong audio signals to keep the transmitter deviation within its maximum limits. The output of the limiter is applied to the second audio amplifier.

g. Second Audio Amplifier. The audio signal from the limiter stage is amplified further by second audio amplifier V413. The audio output from this tube is applied to the control grid of the phase modulator tube to produce a phase modulated signal as described in *b* above.

59. Block Diagram of Radio Receiver R–394/U

a. General. The signal paths through the receiver are shown in the block diagram (fig. 34) and a complete schematic diagram is shown in figure 67. For a more detailed explanation of the receiver circuits, refer to the instruction book for Radio Receiver R–394/U.

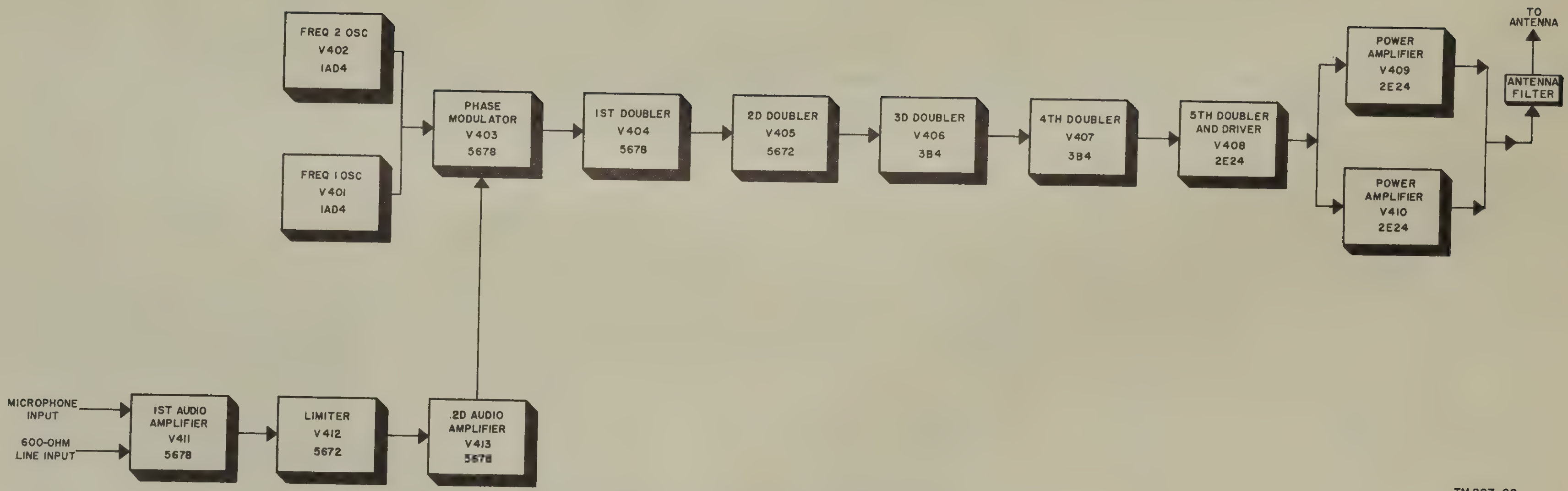
b. RF AMPL 152–174 MC Plug-in Unit. An fm signal from the antenna is fed to first rf amplifier V1 where it is amplified. It is amplified still further by the action of second rf amplifier V2. The two rf amplifiers also improve the signal plus noise-to-noise ratio and the image rejection ratio of the receiver. The gain of the rf amplifiers is controlled by a delayed automatic gain control (agc) voltage developed in the grid circuit of the fifth 455-kc intermediate-frequency (if.) amplifier V85 (2ND IF DISCR plug-in unit). The amplified signal is coupled into first mixer V3 where it is mixed with a signal from the LOCAL OSC 152–174 MC plug-unit (V31, V32, V33), the output of which is 7.8 mc lower in frequency than the incoming rf signal. Sum and difference beat frequencies result, but only the difference frequency of 7.8 mc is accepted by the following stage.

c. 1ST IF 7.8 MC Plug-in Unit. The 7.8-mc if. signal is amplified in 7.8-mc. if amplifier V51 and coupled to second mixer V52 where it is mixed with a 7.345-mc signal from second high-frequency crystal oscillator V53. As a result of the mixing, a second if. of 455 kc is developed. This if. signal is applied to first 455-kc if. amplifier V81 through a selectivity filter (Z251). The filter functions to limit the bandwidth of the if. signal to 15 kc above and below 455 kc.

d. 2D IF DISCR Plug-in Unit. The if. signal is amplified by five 455-kc if. amplifiers, V81 through V85. A portion of the negative dc voltage developed at the grid of fifth 455-kc if. amplifier V85 is used as a delayed agc voltage to control the gain of first and second rf amplifiers V1 and V2. The output of V85 passes through two limiters, V86 and V87, which reduce noise due to amplitude variations in the signal by maintaining a constant amplitude voltage input to the discriminator. Discriminator rectifiers, CR81 and CR82, change the frequency-modulated if. signal into an audio voltage that is applied to first audio amplifier V121 for amplification.

e. LOCAL OSC 152–174 MC Plug-in Unit. The local oscillator plug-in unit contains first high-frequency crystal-oscillator V31 that produces signals between the frequency limits of 24.033 mc and 27.7 mc. A tripler and a doubler stage (V32 and V33) multiply this frequency by 6 and produce a signal within a frequency range of 144.2 mc to 166.2 mc. To gain stability, the operating frequency of the oscillator (V31) is crystal-controlled. The signal stability is gained by the use of a voltage regulator V34. The signal from the doubler is applied to first mixer V3 in the rf amplifier plug-in unit, as explained in *b* above.

f. AUDIO and SQUELCH Plug-in Unit. Audio signals from the discriminator (*d* above) are amplified by first audio amplifier V121 and audio power amplifier V122 to a level that is high enough to drive the handset and the loudspeaker in the control unit. Audio signals from the discriminator also are fed to noise amplifier V123 where the noise frequencies are amplified and coupled to squelch tube V124. The squelch tube makes first audio amplifier V121 and audio power amplifier tube V122 inoperative when no signal is being received; thus excessive noise will not be heard in the earphone or speaker during periods of no signal reception. Squelch clamp tube V125 acts to prevent the control voltage from the



TM 297-98

Figure 33. *Radio transmitter T–278/U; block diagram.*

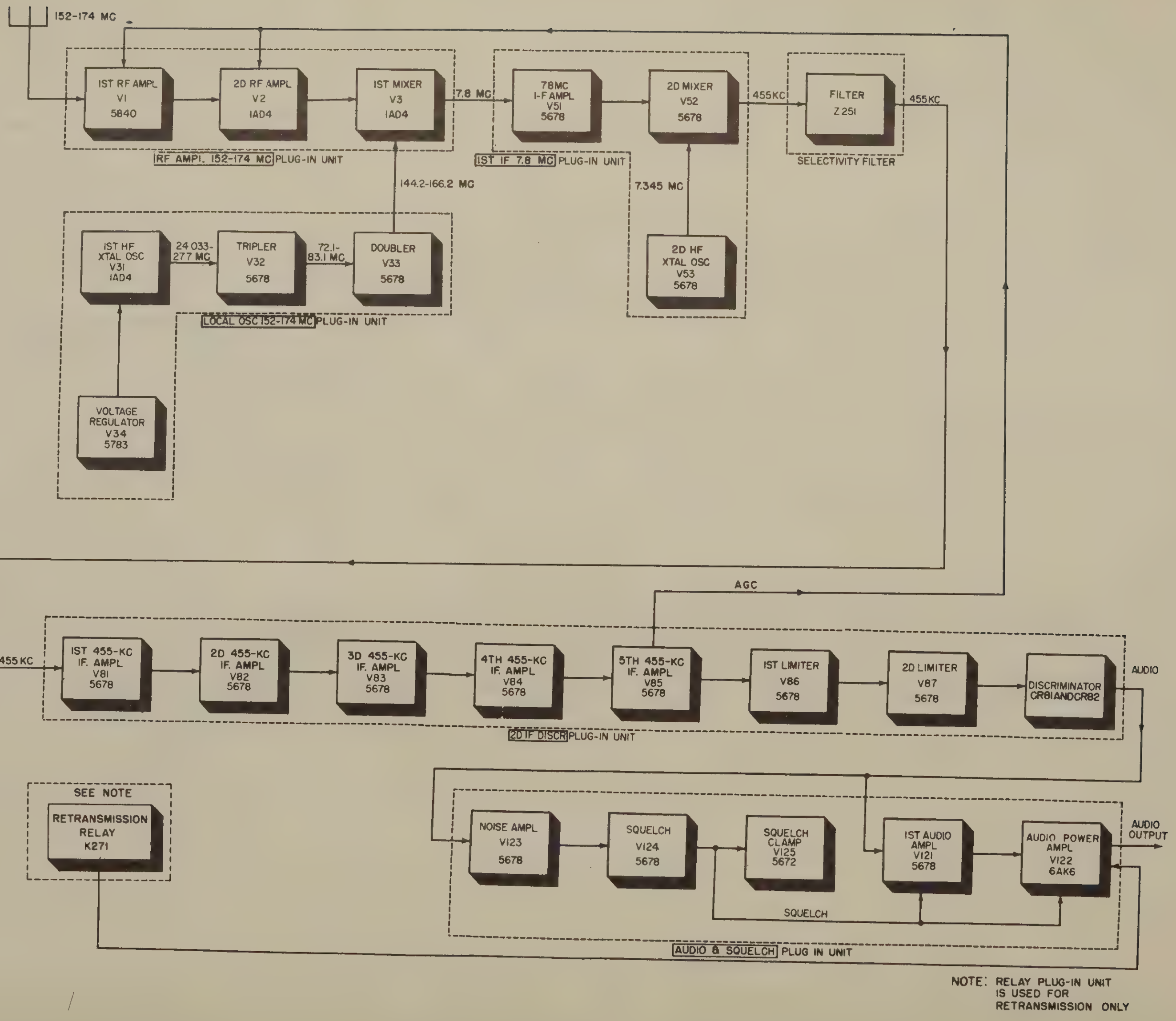
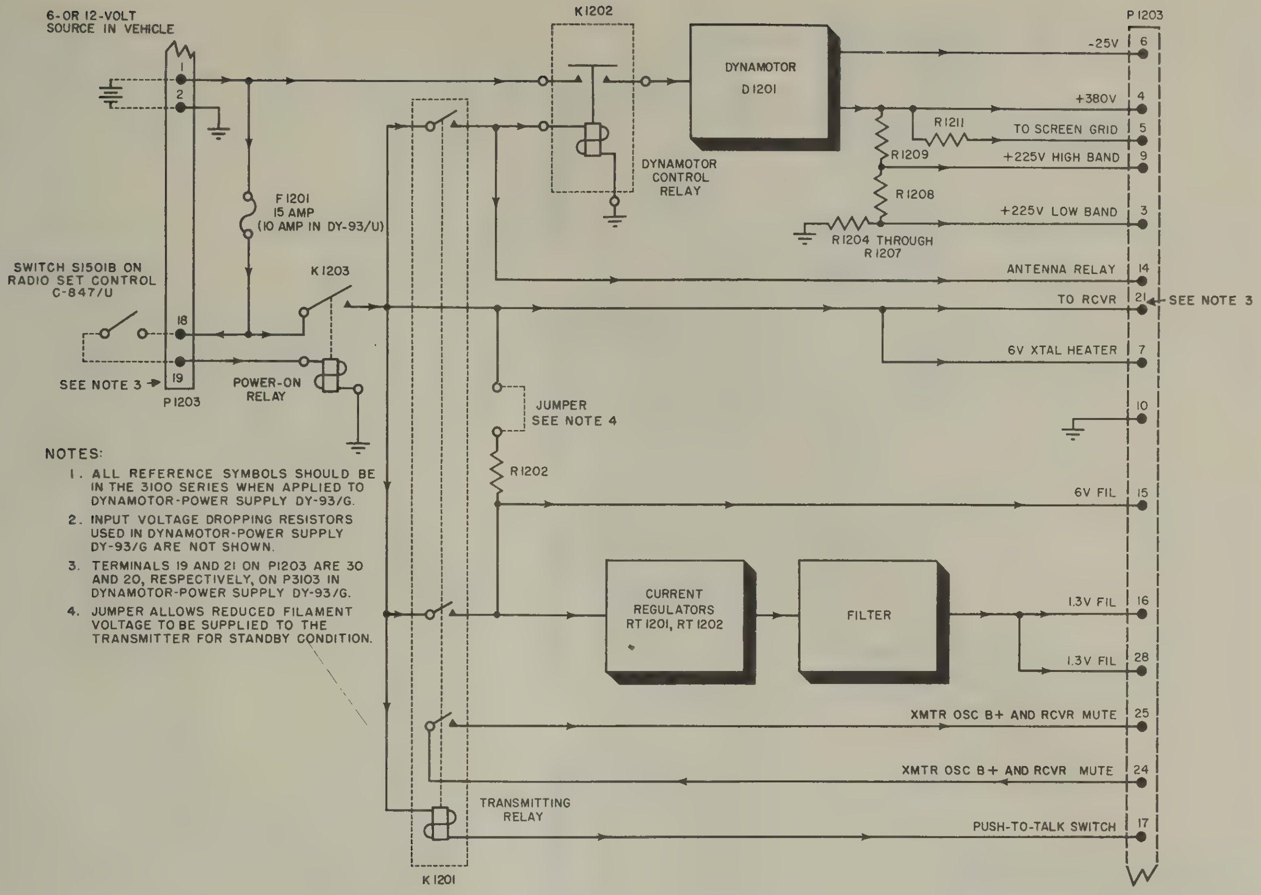


Figure 34. Radio receiver R-394/U, block diagram.



NOTES:

1. ALL REFERENCE SYMBOLS SHOULD BE IN THE 3100 SERIES WHEN APPLIED TO DYNAMOTOR-POWER SUPPLY DY-93/G.
2. INPUT VOLTAGE DROPPING RESISTORS USED IN DYNAMOTOR-POWER SUPPLY DY-93/G ARE NOT SHOWN.
3. TERMINALS 19 AND 21 ON P1203 ARE 30 AND 20, RESPECTIVELY, ON P3103 IN DYNAMOTOR-POWER SUPPLY DY-93/G.
4. JUMPER ALLOWS REDUCED FILAMENT VOLTAGE TO BE SUPPLIED TO THE TRANSMITTER FOR STANDBY CONDITION.

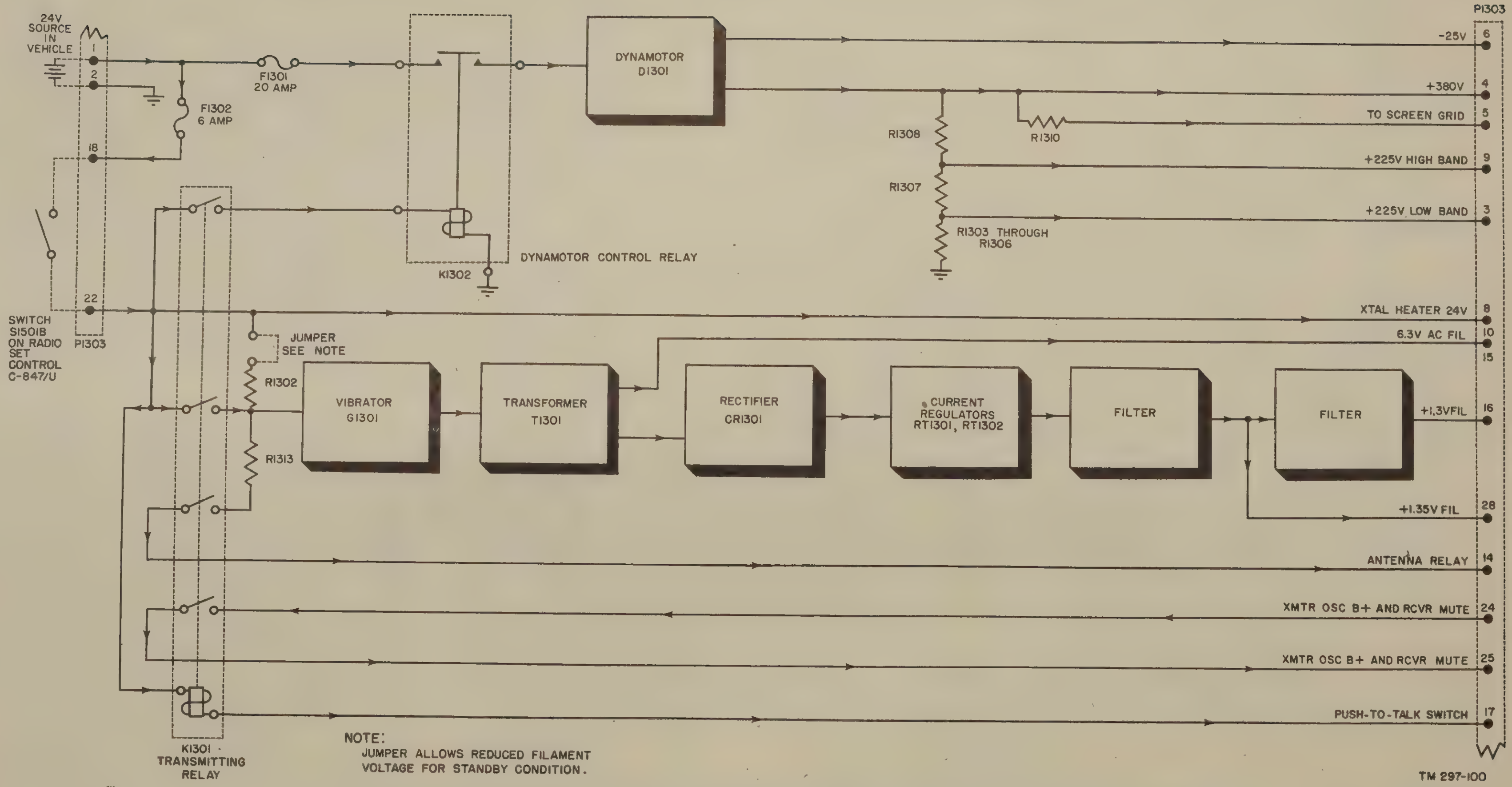
Figure 35. Dynamotor-power supplies DY–93/G and DY–100/U, functional block diagram.

squelch tube (V124) from going positive when a signal is being received. Retransmission relay K271 turns the transmitter on when a signal is being received during retransmission operation (par. 37). The relay is used for retransmission only and normally is not supplied with the equipment.

60. Block Diagram of Dynamotor-Power Supply DY-100/U

a. The power and control circuits in Dynamotor-Power Supply DY–100/U are shown in the block diagram of figure 35 and are described in *b* below. The main schematic diagram is shown in figure 61. For a more detailed explanation, refer to the instruction book for Dynamotor-Power Supply DY–100/U. This dynamotor supplies power to the transmitter when a 6-volt storage battery is used as the primary power source.

b. A single multipin connector, P1203, connects the power supply to the equipment cabinet. Since the battery supply is 6 volts, it can be used in the 6-volt circuits without the use of vibrators and transformers. The input current, needed to operate the power supply, is controlled by power-on relay K1203. This relay is energized by turning the VOLUME-OFF switch on the control unit to some position other than OFF. It distributes the battery voltage to the receiver power supply, to the coil and contacts of relay K1201, and to the internal circuits of the transmitter power supply. Relay K1201 is actuated by pressing the push-to-talk switch on the handset. It allows voltage to be supplied to the filament and dynamotor circuits. In addition to controlling the above voltages, power supply relay K1201 also actuates the antenna change-over relay in the transmitter and closes a receiver mute circuit. The input current for the dynamotor is controlled by contactor K1202 that is energized through contacts of relay K1201. Dynamotor D1201 supplies B+ voltages of 380 volts and 225 volts, and a bias voltage of −25 volts to the transmitter. Voltage regulation is provided in the 1.3-volt filament circuit by two



NOTE:
JUMPER ALLOWS REDUCED FILAMENT VOLTAGE FOR STANDBY CONDITION.

Figure 36. Dynamotor-power supply DY-98/G, functional block diagram.

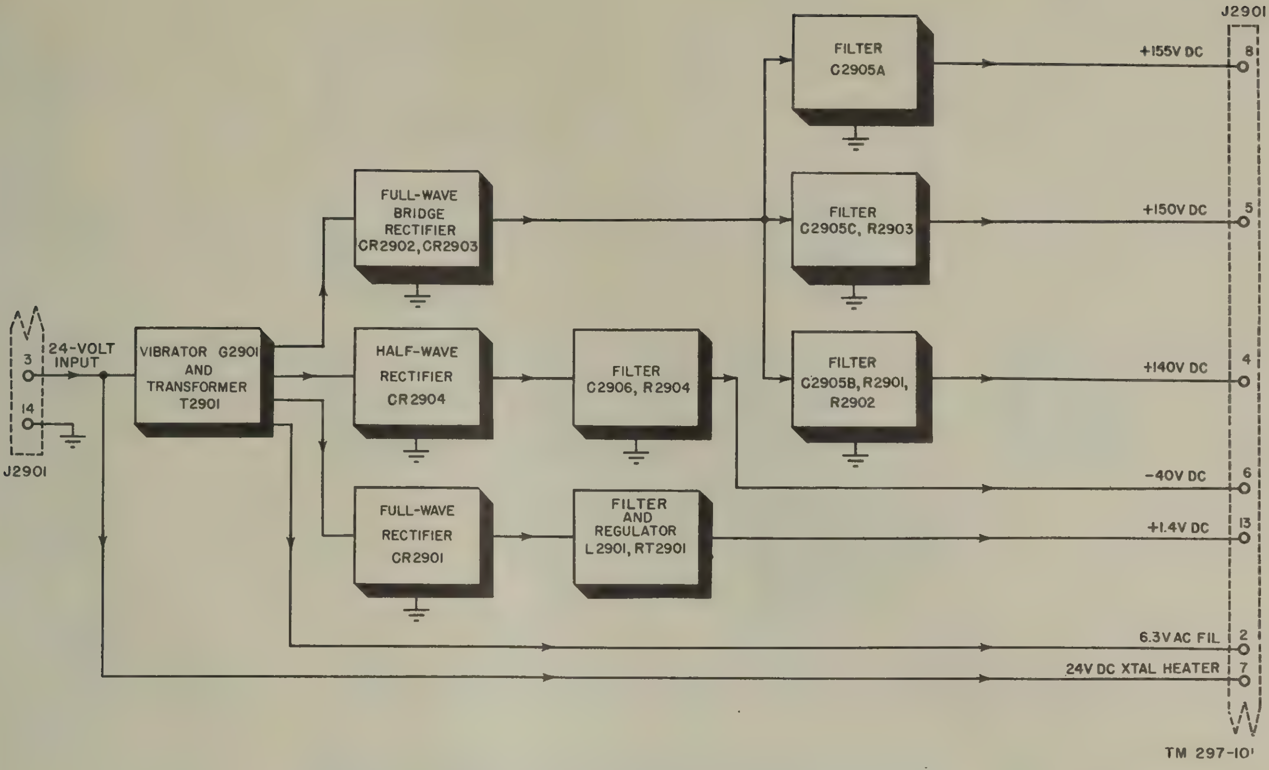

J2901
FILTER C2905A
+155V DC
8
FULL-WAVE BRIDGE RECTIFIER CR2902, CR2903
FILTER C2905C, R2903
+150V DC
5
3
24-VOLT INPUT
14
J2901
VIBRATOR G2901 AND TRANSFORMER T2901
HALF-WAVE RECTIFIER CR2904
FILTER C2906, R2904
FILTER C2905B, R2901, R2902
+140V DC
4
-40V DC
6
FULL-WAVE RECTIFIER CR2901
FILTER AND REGULATOR L2901, RT2901
+1.4V DC
13
6.3V AC FIL
2
24V DC XTAL HEATER
7
TM 297-10'

Figure 37. Power supply PP–869/U, functional block diagram.

current regulating resistors, RT1201 and RT1202. The output of the filament circuit is applied through two paths to the transmitter. One path supplies the if. stages of the transmitter while the other supplies the modulator and audio stages.

61. Block Diagram of Dynamotor-Power Supply DY–93/G

(fig. 35)

The circuits of Dynamotor-Power Supply DY–93/G are very similar to those in Dynamotor-Power Supply DY–100/U (par. 60). The main difference between the power supplies is that several additional voltage-dropping resistors are required in Dynamotor-Power Supply DY–93/G to reduce the 12-volt input voltage to 6 volts. Refer to the main schematic (fig. 62), for this difference.

62. Block Diagram of Dynamotor-Power Supply DY–98/G

a. The power and control circuits in Dynamotor-Power Supply DY–98/G are shown in the block diagram of figure 36 and are described in *b* below. The main schematic diagram is shown in figure 63.

b. The input and high-voltage circuits of Dynamotor-Power Supply DY–98/G are similar to those in the 6- and 12-volt power supplies described in paragraphs 60 and 61. However, the power-on relay (K1203), shown in the 6- and 12-volt block diagram (fig. 35), is not used in the 24-volt model. Because of the lower input current in the 24-volt model, the VOLUME-OFF switch on the radio set control is used to control relay K1301 directly instead of through a power-on relay. The manner in which the filament voltage is derived is quite different. The 24-volt input is changed to ac by vibrator G1301 and applied to transformer T1301. The 6-volt tube filaments of the transmitter are provided with ac voltage from the secondary of the transformer. A portion of the secondary voltage is rectified by full-wave selenium rectifier CR1301 and applied to the 1.3-volt filament circuit through current regulators RT1301 and RT1302 and two filter sections.

63. Block Diagrams of Power Supplies PP–867/U, PP–868/U, and PP–869/U

a. The curcuits of the receiver power supplies are shown in block diagram form in figures 37, 38, and 39 and are described in *b* below. The main schematic diagrams are shown in figures 64,

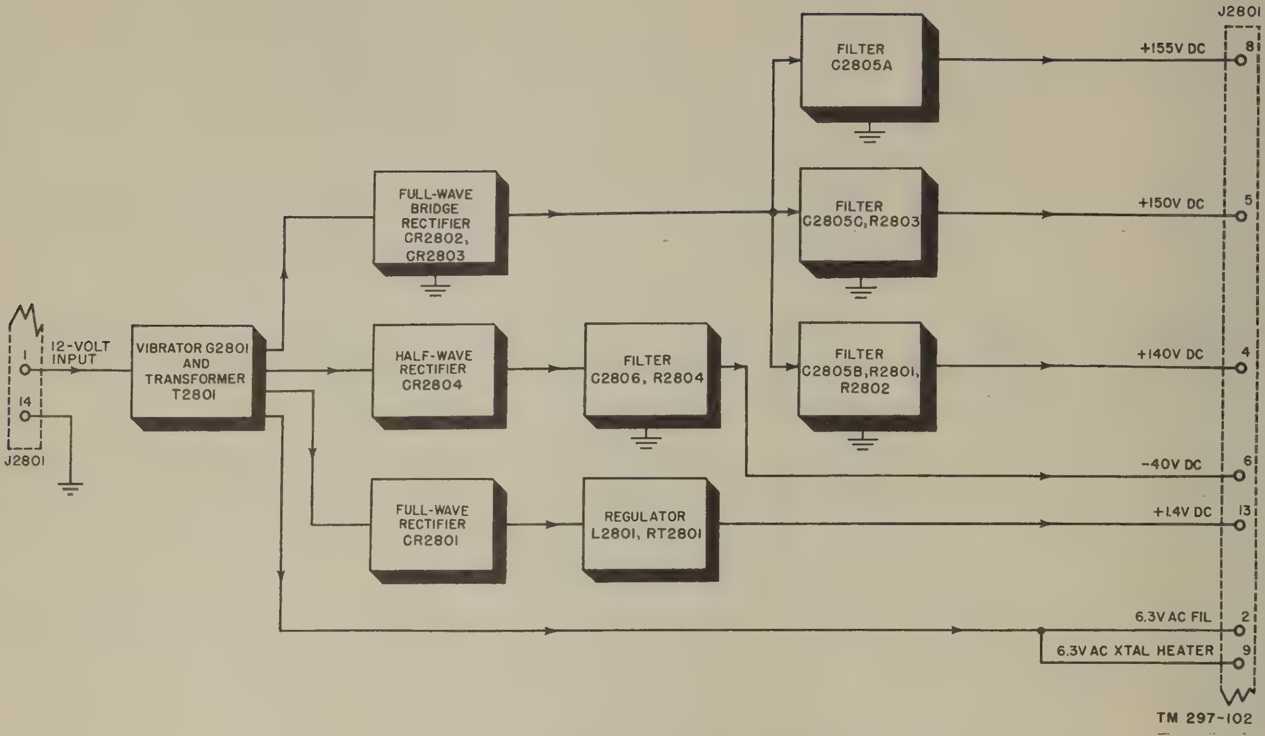


Figure 38. Power supply PP–868/U, functional block diagram.

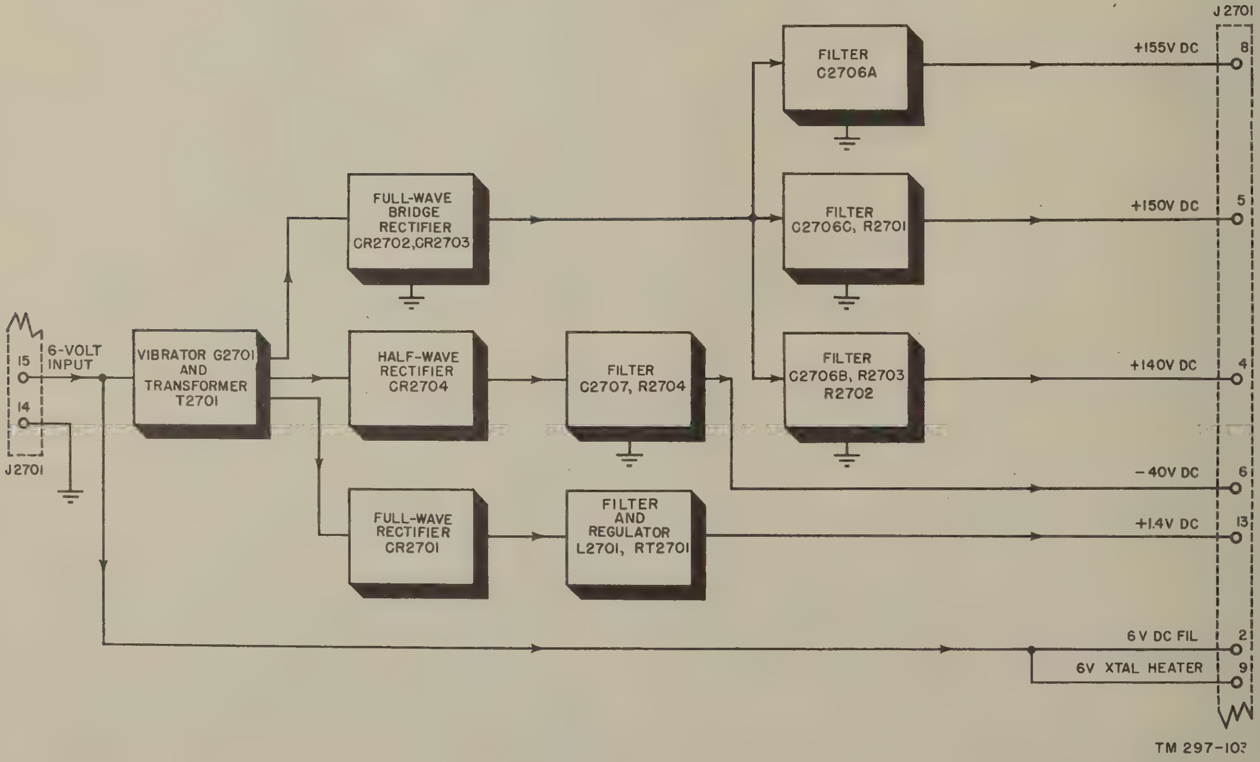

J 2701
FILTER C2706A
+155V DC
8
FULL-WAVE BRIDGE RECTIFIER CR2702, CR2703
FILTER C2706C, R2701
+150V DC
5
6-VOLT INPUT
15
14
J2701
VIBRATOR G2701 AND TRANSFORMER T2701
HALF-WAVE RECTIFIER CR2704
FILTER C2707, R2704
FILTER C2706B, R2703 R2702
+140V DC
4
-40V DC
6
FULL-WAVE RECTIFIER CR2701
FILTER AND REGULATOR L2701, RT2701
+1.4V DC
13
6 V DC FIL
2
6V XTAL HEATER
9
TM 297-103

Figure 39. Power supply PP–867/U, functional block diagram.

65, and 66. For a more detailed explanation, refer to the instruction book covering Power Supplies PP–867/U, PP–868/U, and PP–869/U.

b. The circuits of the receiver power supplies are very similar, with minor exceptions. In all three models, the input voltage from the power source is applied through two terminals of a multicontact connector to a vibrator that converts the dc battery voltage to an ac voltage. It is then applied to a transformer that produces the various voltages required to produce the receiver operating voltages. One transformer output is rectified by a full wave bridge rectifier and applied to three paralleled filters to produce the 140-, 150-, and 155-volt dc operating potentials. A second voltage is taken from the secondary of the transformer and applied to a half wave rectifier and a filter to obtain the 40-volt receiver bias. Half wave rectification is possible because of the low current drain of the bias circuit. This makes filtering easier and full wave rectification is unnecessary. The third transformer secondary voltage is rectified by a full wave rectifier and applied to a current regulating system to produce the 1.4-volt filament supply. Power Supplies PP–867/U (24-volt model) and PP–868/U (12-volt model) have a fourth transformer output that supplies 6.3 volts ac to the filaments of the 6.3-volt receiver tubes. The 12-volt model uses this same source for the crystal oven heater. The 24-volt model, however, uses the primary power source voltage of 24 volts to operate the crystal oven heater. Power Supply PP–869/U (6-volt model) does not have the 6.3-volt ac transformer output. This output can be eliminated because the primary source voltage of 6 volts is fed directly through the power supply to the receiver 6-volt tube filaments and to the crystal oven. The above differences in circuits can be seen readily by comparing the schematic diagrams of the three power supplies.

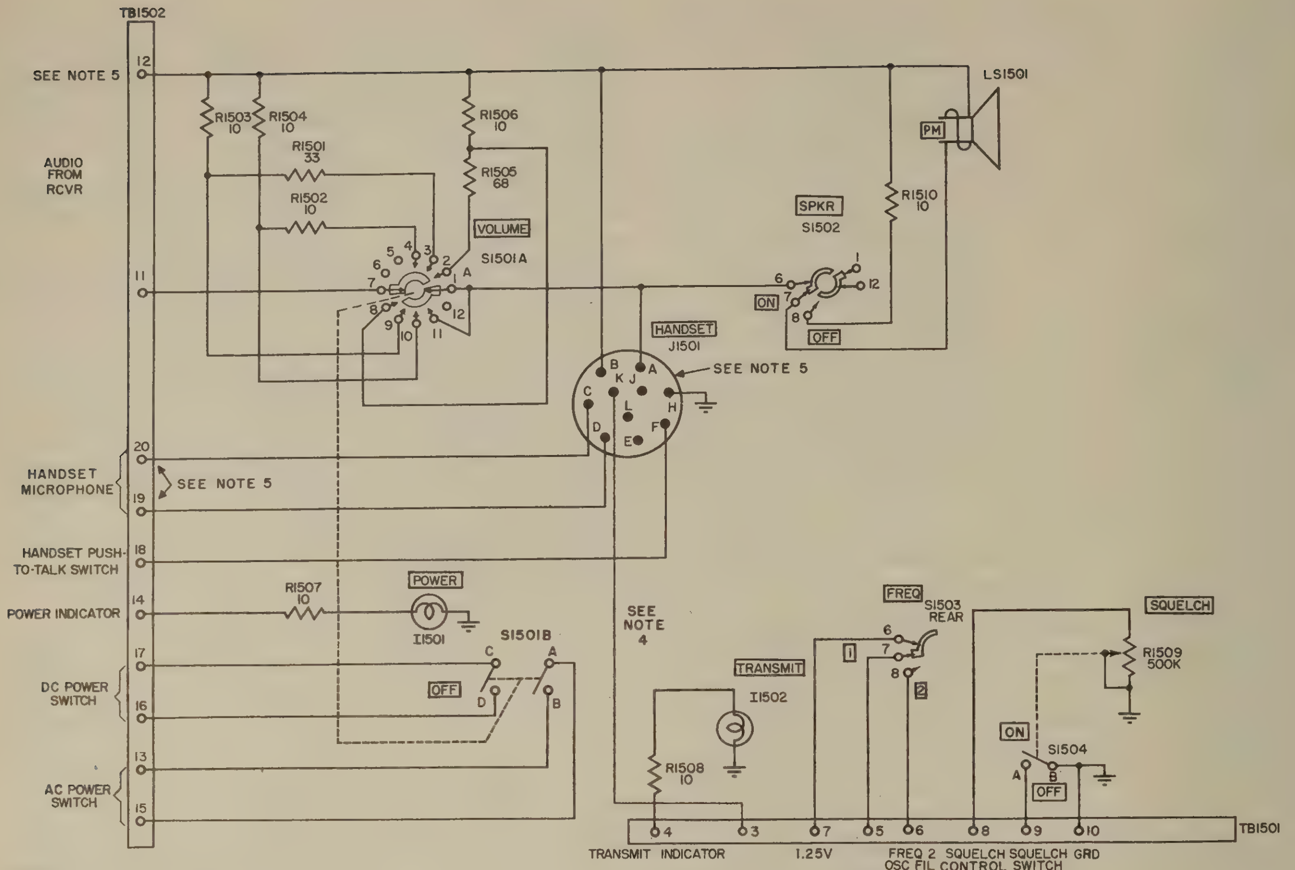
64. Theory of Electrical Equipment Cabinet CY–938(*)/VRC

The equipment cabinet consists of numerous connectors and cables of wires that are used to make the interconnections between components. The radio set has been designed so that interconnections are contained mostly in the equipment cabinet; these interconnections in conjunction with the jacks allow simplified and automatic connections when the components are installed in the equipment cabinet. The wiring is intricately related to all the components in the radio set and, therefore, cannot be explained separately. Information concerning the wiring is given throughout this chapter. Besides the internal wiring of the equipment cabinet, there are connections to three external circuits. One is the antenna circuit that connects through a coaxial cable to a connector on the side of the equipment cabinet. The second circuit is used to bring the dc power from the vehicle battery to the equipment cabinet and contains a fuse (F801) that has a capacity of 50 amperes and protects the power source. The third circuit consists of a 20-wire cable to connect the equipment cabinet to the control unit. The wires in the cable are connected to terminal boards TB804 and TB805 in the equipment cabinet. A schematic diagram of the equipment cabinet is shown in figure 58.

65. Theory of Radio Set Control C–847/U

a. General. The control unit controls the radio set after the presetting adjustments have been made. The circuits of the control unit are connected to the equipment cabinet through a 20-wire cable, where they are distributed to the other components. The circuits fall into three general categories: audio, control, and indication. Many of the circuits in the control unit depend on the operation of circuits in other components, and are described in detail along with the theory of the components and circuits they control. Refer to figure 40 for the schematic diagram of the control unit.

b. Power Control. Power switch S1501B controls the power to the radio set. It is coupled mechanically to the VOLUME-OFF switch S1501A so that only one knob is necessary for both power and VOLUME control. In the OFF position of this control, S1501B is open and prevents power from being applied to the radio set. The connections to the switch for dc power are through terminals 16 and 17 of TB1502. Connections are provided for a 115-volt ac power source (not normally used in Radio Set AN/VRC–19(*)) through terminals 13 and 15 of TB1502. For more details on how the switch functions in the overall circuit, refer to paragraphs 69, 70, and 71. Another power control switch is located in the handle of the handset (fig. 41). This is the push-to-talk switch that is connected to the control unit through terminals F and H of J1501. It is a low-voltage switch, used to energize



NOTES:

1. ALL RESISTORS ARE IN OHMS.
2. SWITCH S1501 SHOWN IN OFF POSITION.
3. SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
4. FOR UNITS BEARING SERIAL NUMBERS BELOW 496, THERE IS NO CONNECTION BETWEEN PIN 3 OF TB1501 AND PIN K OF J1501.
5. FOR UNITS SERIAL NUMBERED 601 OR ABOVE, TERMINALS 12 AND 11 OF TB1502 SHOULD BE RENUMBERED TO READ 11 AND 12, RESPECTIVELY; PINS E AND H OF J1501 ARE CONNECTED BY A JUMPER; THERE IS NO CONNECTION BETWEEN TERMINAL 19 OF TB1502 AND PIN D OF J1501; TERMINALS 19 AND 20 OF TB1502 SHOULD BE RENUMBERED TO READ 20 AND 19, RESPECTIVELY.

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Figure 40. Radio set control C–847/U, schematic diagram.

power controlling relays that switch the radio set from receive to transmit conditions.

c. Receiver Audio. Signals from the receiver (applied through terminals 11 and 12 of TB1502) pass through VOLUME-OFF switch S1501A and an attenuator pad to the handset receiver or speaker. This circuit changes the audio level when the position of the switch is varied. SPKR switch S1502 is used to remove speaker LS1501 from the circuit when it is not being used and substitutes loading resistor R1510. Details of these circuits are covered fully in paragraph 66.

d. Transmitter Audio. On Radio Set Control C–847/U (units with serial numbers from 1 to 600) the output of the handset microphone is taken from the control unit through terminals C and D of J1501 and terminals 19 and 20 of TB1502 (fig. 44). On control units with serial numbers of 601 and higher, the output of the handset microphone is taken from the control unit through terminals C and E of J1501 and terminal 19 of TB1502 and ground (fig. 45). Refer to paragraph 67 for more information concerning connections between the microphone and transmitter.

e. Control. FREQ 1–2 switch S1503 is provided to allow the operator to switch between two preset transmitting frequencies. The switch connects filament voltage to the transmitter oscillator tube that is to be used for the desired frequency and removes it from the other oscillator tube. The 1.25-volt filament voltage is brought into the control unit at terminals 7 and 10 (ground) of TB1501 (fig. 40). The switch then distributes it to one of the two terminals, 5 or 6, depending

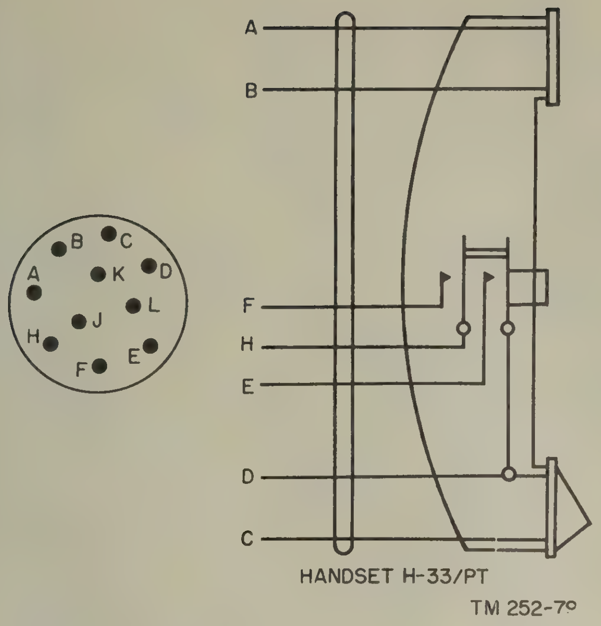


Figure 41. Handset H–33/PT, schematic diagram.

on the chosen frequency. When the switch is in the No. 1 position it is connected to terminal 5 and applies filament voltage to the frequency 1 oscillator filament. In the No. 2 position, the 1.25 volts are applied through terminal 6 of TB1501 to heat the filament of the frequency 2 osciallator tube. SQUELCH control, R1509 and S1504, is a potentiometer and switch combination. The SQUELCH switch, S1504, when closed, disables the squelch circuit by grounding its output circuit through terminal 9 of TB1501. The squelch potentiometer, R1509, controls (through terminal 8 of TB1501) the level at which squelching action occurs. As the resistance of the squelch potentiometer is decreased (control turned counterclockwise), the squelch circuit has more effect in quieting the receiver. A complete explanation of this circuit can be found by referring to the instruction book covering Radio Receiver R–394/U.

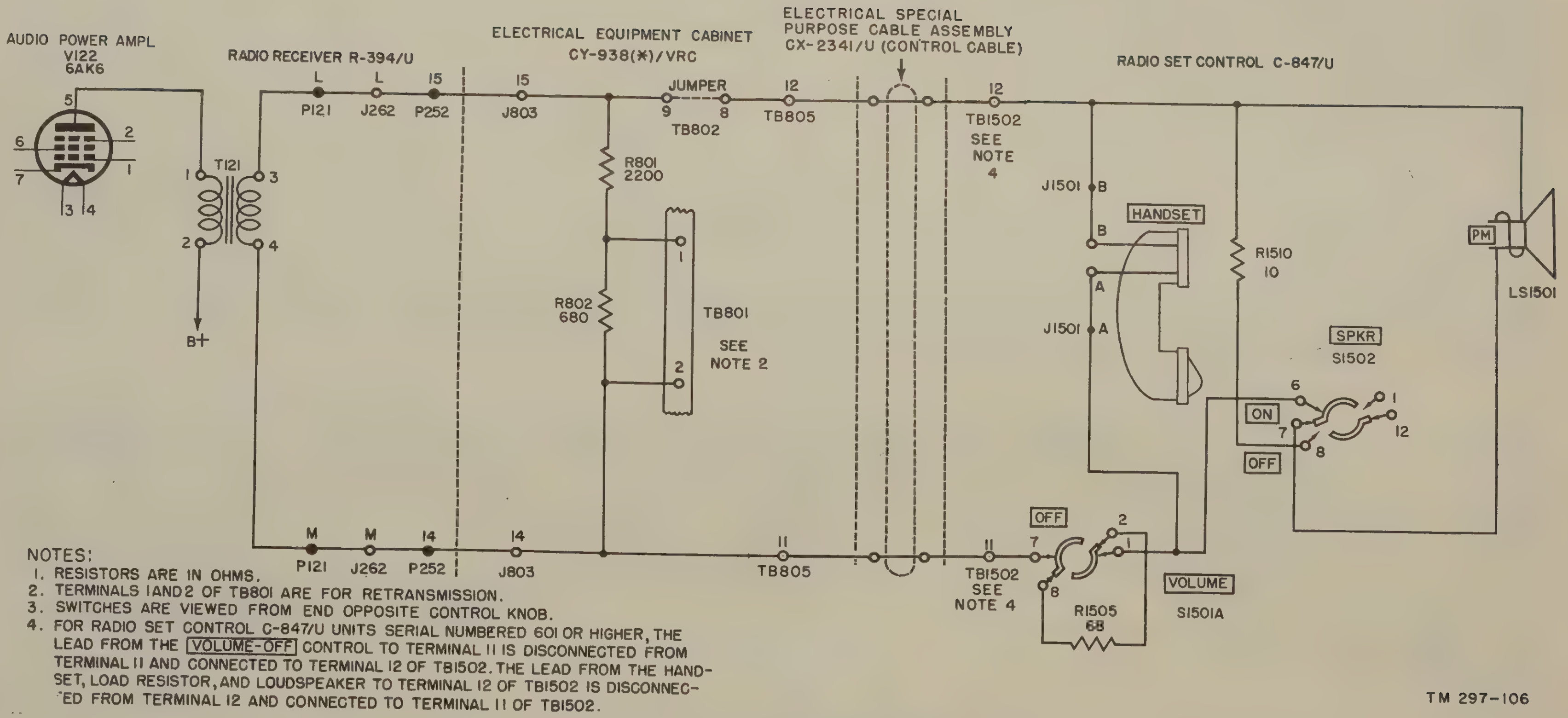
f. Indicators. Two indicator lamps are incorporated in the control. POWER lamp I 1501 indicates when power is supplied to the radio set. Resistor R1507 is connected in series with the lamp to limit current through it. The lamp receives its power through terminal 14 of TB1502 and 10 of TB1501 (ground). TRANSMIT lamp I 1502 lights when the transmitter is in operation. This lamp also has a current limiting resistor (R1508) in series with it. Power to the lamp is applied through terminals 4 and 10 (ground) of TB1501 only when the transmitter is operating.

66. Audio Output of Receiver

(fig. 42)

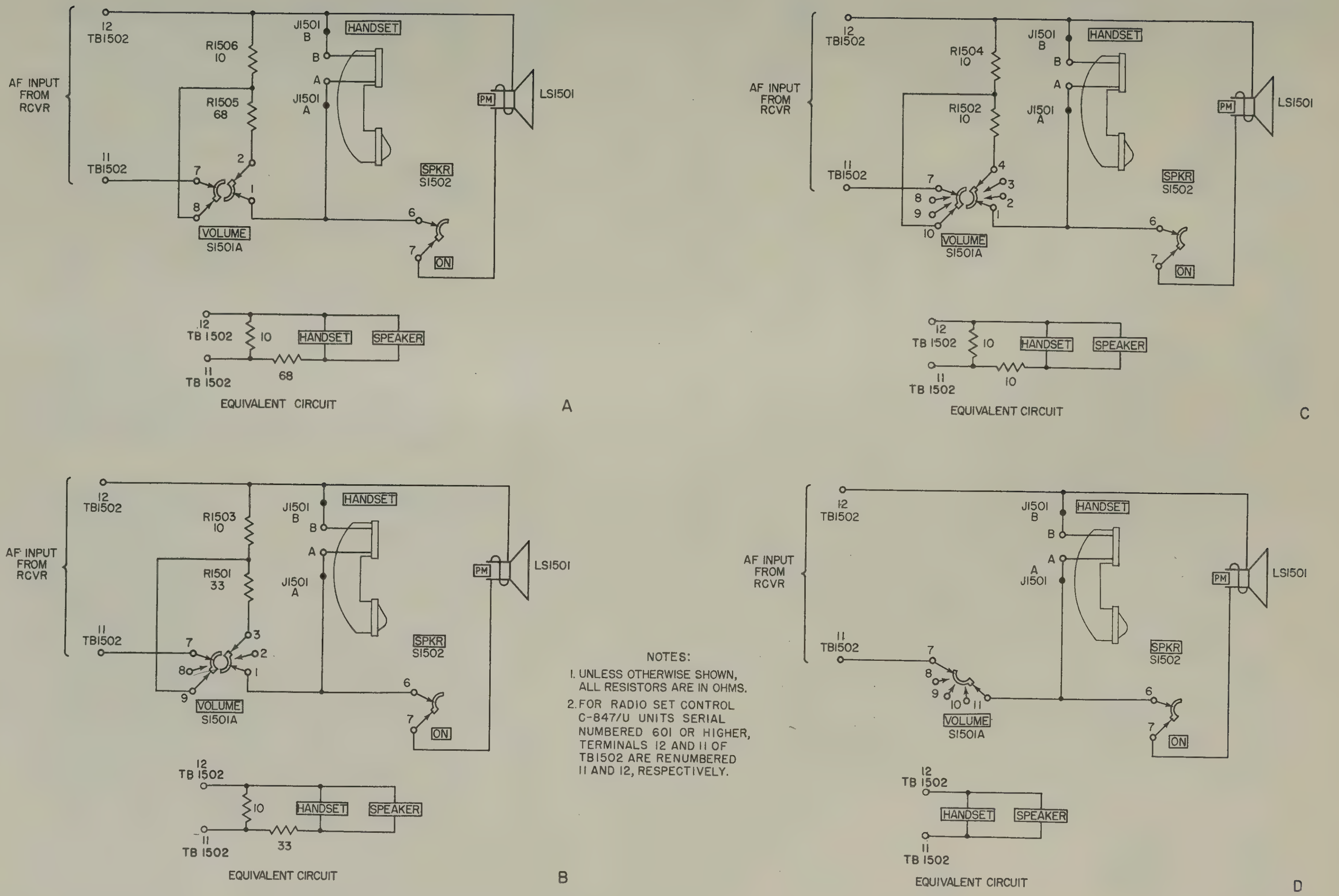
a. General. The audio output of the receiver is developed across the secondary of transformer T121 (terminals 3 and 4). From the transformer, the signal takes a path through plug-in unit connectors P121 and J262, receiver main connector P252, and through the equipment cabinet to the control unit. At the control it is applied to the handset receiver or speaker. SPKR switch S1502 is provided to disconnect the speaker so that only the handset receives the audio signal (if desired). The switch is spring-loaded and must be held in the OFF position. When the speaker is out of the circuit, it is replaced by 10-ohm resistor R1510, through contacts 6 and 8, in order to keep a constant load on the audio transformer. In the equipment cabinet, series resistors R801 and R802 are connected across the audio line. These resistors form an attenuator and matching network and are used, during retransmission, to feed the the audio signal to the audio amplifier in the transmitter. The retransmission circuit is described in detail in paragraph 67. A jumper between terminals 8 and 9 of TB802 permits the audio to be disconnected from the speaker and handset, if desired, while retransmission is taking place. Resistor R1505 is used in the attenuator circuit and is described in *b* below.

b. Volume Attenuator Circuit. Figure 43 shows the positions of VOLUME-OFF switch S1501A and the various resistors that are inserted in the circuit to control the level of the audio signal applied to the handset receiver or speaker. The switch allows four volume levels. In the first position clockwise from OFF, shown in A of figure 43, a 10-ohm resistor R1506 is connected in parallel with the secondary of the audio output transformer. At the same time, 68-ohm resistor R1505 is connected in series with the handset receiver or speaker. This results in the application of approximately one-eighth of the input voltage across the speaker and handset. For the position of S1501A, shown in B, the 68-ohm resistor is automatically replaced by 33-ohm resistor R1501. This arrangement raises the level so that there is approximately one-fourth of the input voltage across the speaker and handset. In C, the 10-ohm resistor is replaced by resistor R1504 (10 ohms) and the 33-ohm resistor is replaced by resistor



NOTES:
1. RESISTORS ARE IN OHMS.
2. TERMINALS 1 AND 2 OF TB801 ARE FOR RETRANSMISSION.
3. SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
4. FOR RADIO SET CONTROL C-847/U UNITS SERIAL NUMBERED 601 OR HIGHER, THE LEAD FROM THE VOLUME-OFF CONTROL TO TERMINAL 11 IS DISCONNECTED FROM TERMINAL 11 AND CONNECTED TO TERMINAL 12 OF TB1502. THE LEAD FROM THE HANDSET, LOAD RESISTOR, AND LOUDSPEAKER TO TERMINAL 12 OF TB1502 IS DISCONNECTED FROM TERMINAL 12 AND CONNECTED TO TERMINAL 11 OF TB1502.

Figure 42. Audio output to handset and speaker, simplified.



NOTES:

1. UNLESS OTHERWISE SHOWN, ALL RESISTORS ARE IN OHMS.
2. FOR RADIO SET CONTROL C-847/U UNITS SERIAL NUMBERED 601 OR HIGHER, TERMINALS 12 AND 11 OF TB1502 ARE RENUMBERED 11 AND 12, RESPECTIVELY.

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Figure 43. *Radio set control C–847/U, volume control circuit, simplified.*

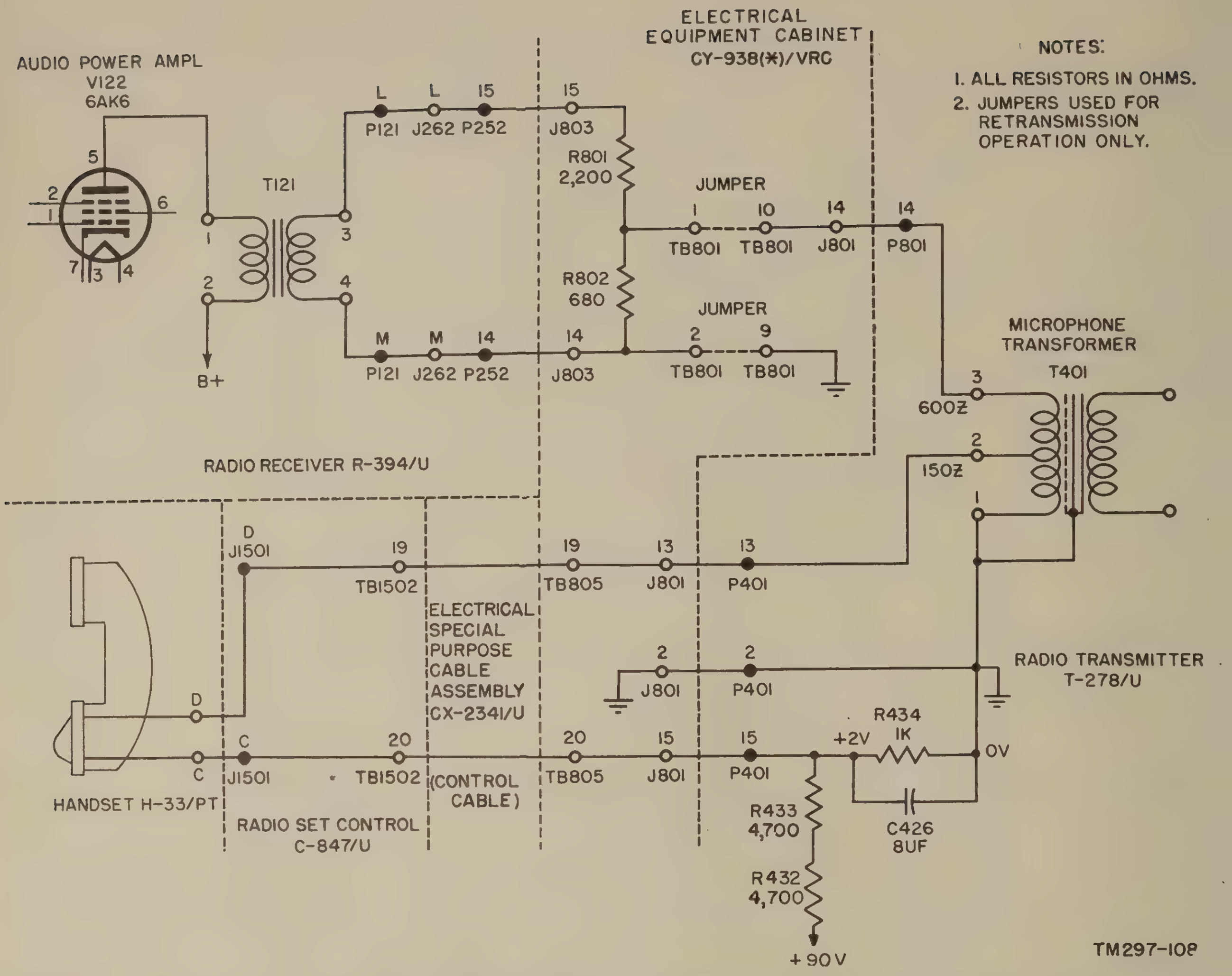


Figure 44. *Microphone and retransmission audio circuits (applies only to radio sets using radio set control C–847/U units with serial numbers from 1 to 600).*

R1502 (10 ohms). The substitution results in approximately one-half of the input voltage being applied to the speaker and handset. The last circuit, shown in D, illustrates a direct connection from the audio frequency input to the handset and speaker so that there is no reduction in signal strength between the input and the handset and speaker.

67. Microphone and Retransmission Circuit

(figs. 44 and 45)

a. Microphone Circuit. Handset H–33/PT contains a carbon type microphone that is connected across the 150-ohm impedance winding (terminals 1 and 2) of transmitter microphone transformer T401. The connection is made to the transmitter through the control unit, control cable, and equipment cabinet. The lower branch of the connection contains a series resistor, R434, which is a part of a voltage divider located in the transmitter from B+ to ground. The other resistors in the divider are R432 and R433. A 2-volt dc drop across resistor R434 supplies the necessary current for the microphone circuit. Resistor R434 is bypassed for audio frequencies by capacitor C426.

b. Retransmission Circuit. The retransmission circuit uses the same audio input transformer (T401) in the transmitter but requires a 600-ohm impedance. This impedance is provided across terminals 1 and 3 of the transformer. The output from the receiver audio output transformer T121 (terminals 3 and 4) is fed through interconnections in the receiver to the equipment cabinet where it is applied across a series network consisting of resistors R801 and R802. The network is a voltage divider and impedance-matching circuit. The

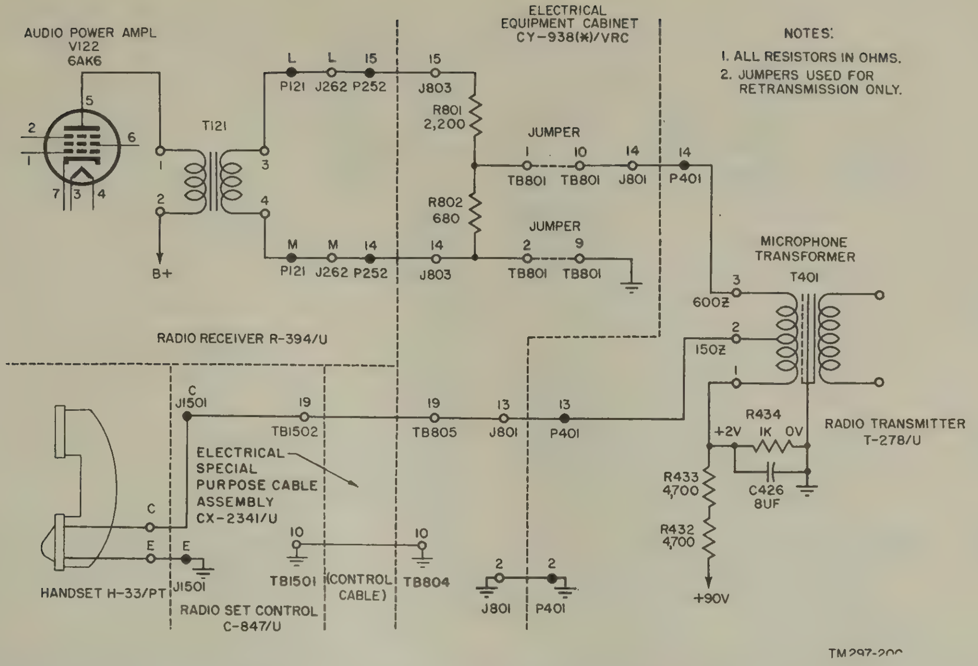


Figure 45. Microphone and retransmission audio circuits (applies only to radio sets using radio set control C–847/U units with serial numbers above 600).

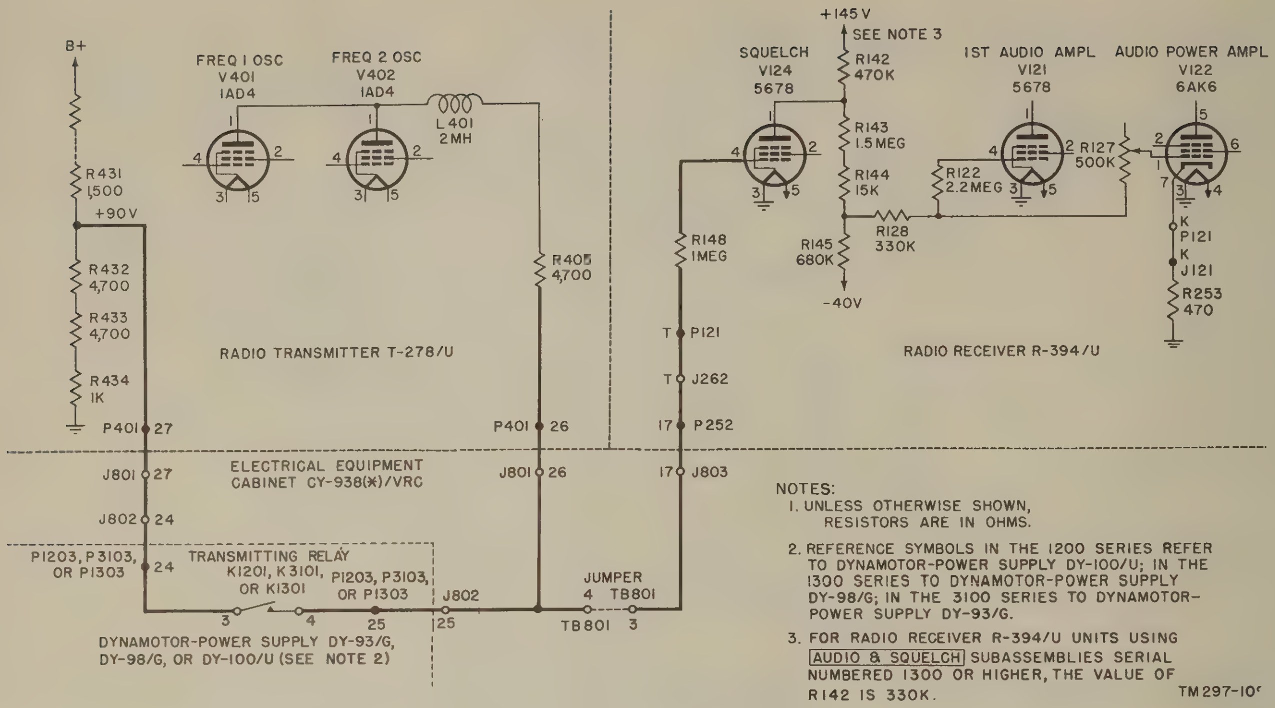
portion of the audio signal developed across resistor R802 is applied to the primary of transformer T401 (terminals 1 and 3). Resistor R802 is 680 ohms and approximately matches the 600-ohm impedance of the transformer. Jumper connections from 1 to 10 and from 2 to 9 of terminal board TB801 permit the retransmission circuit to be disconnected when not needed. The jumper connections are located at the rear of the equipment cabinet (fig. 21).

68. Receiver Mute Circuit

a. When push-to-talk operation is used, the antenna changeover relay (K401) in the transmitter switches the antenna from the receiver input to the transmitter output. The action removes the signal from the receiver except for noise and leakage signal from the transmitter (if it happens to be transmitting on a nearby frequency). To silence the receiver, a receiver muting circuit is used.

b. The circuit (fig. 46) is controlled by a relay in the transmitter power supply; the relay is operated by the push-to-talk switch on the handset. All three transmitter power supplies use contacts 3 and 4 of the relay. A potential of +90 volts, developed across resistors R432, R433, and R434 in the transmitter, passes through interconnections to the relay contacts (fig. 46). From the relay, it is split into two paths; one path goes to the plate circuit of transmitter oscillator tubes V401 and V402 and the other goes to the receiver squelch tube (V124) grid.

c. When the transmitting relay in the transmitter power supply is closed (the push-to-talk switch depressed), the +90-volt potential is applied to the oscillator plate circuit; this causes it to oscillate. At the same time, the potential is applied to the control grid of V124 through current limiting resistor R148. The high positive voltage on the control grid causes the tube to draw a heavier than normal current through its plate load resistor R142. When this occurs, the voltage at the plate of the tube becomes lower; this in turn, decreases the potential differences across resistors R143, R144, and R145. One side of resistor R145 is connected to −40 volts. With very little bucking voltage applied from the plate circuit of the squelch tube, the potential at the junction of resistors R144 and R145 approaches −40 volts. This high negative voltage is applied to the control grid circuits of the first audio and power amplifier stages (V121 and V122) through resistor R128. The high negative bias cuts off the audio tubes and effectively mutes the receiver. When the transmitting relay contacts open, the



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.
2. REFERENCE SYMBOLS IN THE 1200 SERIES REFER TO DYNAMOTOR-POWER SUPPLY DY-100/U; IN THE 1300 SERIES TO DYNAMOTOR-POWER SUPPLY DY-98/G; IN THE 3100 SERIES TO DYNAMOTOR-POWER SUPPLY DY-93/G.
3. FOR RADIO RECEIVER R-394/U UNITS USING AUDIO & SQUELCH SUBASSEMBLIES SERIAL NUMBERED 1300 OR HIGHER, THE VALUE OF R142 IS 330K.

Figure 46. Muting circuit, simplified.

transmitter is disabled and the receiver is able to operate. A jumper connection between terminals 3 and 4 of terminal board TB801 permits removal of this muting action when desired. This jumper must be removed during retransmission operation (fig. 21).

69. Radio Set AN/VRC19–Y Power and Control Circuits (6-Volt Operation)

a. General. The control and low-voltage power circuits are shown in figure 47. A 6-volt battery is connected to the equipment cabinet through a heavy-current capacity cable. A battery with either its positive or negative terminal grounded can be connected to the radio set power circuit without affecting any of the low-voltage circuits. The B+ circuit to the transmitter is provided with a means of changing polarity to make the set adaptable to any vehicle battery polarity (par. 27*f*). After the source voltage enters the equipment cabinet, one side is fused by 50-ampere fuse F801 to protect the vehicular power source. From the fuse, the current takes two paths: one to power switch S1501B in the control unit (through the power supply and the equipment cabinet), and the other to contactor K1202 in the transmitter power supply. On the other side of the battery, contact is made with all common points that are to be switched into the circuit. Note that a jumper is inserted in the circuit between the power switch and the coil of relay K1203. This connection between terminals 1 and 2 of TB803 is used for the 6-volt radio set only. A second fuse, F1201 (upper left part of fig. 47), is connected in series with the major portion of the circuit. This fuse is located in the transmitter power supply, and protects all of the circuits in the radio set except the dynamotor dc supply circuit. When the power switch is closed by rotating the VOLUME-OFF control in a clockwise direction, relay K1203 is energized, and the battery voltage is applied to all power and control circuits in the radio set except the dynamotor circuit and the push-to-talk circuit. Contactor K1202 is energized by the closing of relay K1201 which is energized by either closing the push-to-talk switch or placing the TEST-OFF switch in the TEST position. This completes the battery circuit to the dynamotor.

b. Receiver Circuits. Voltage is applied to the receiver power supply through the transmitter power supply, the equipment cabinet, and the receiver itself (first circuit to right of the contacts of relay K1203 in fig. 47). Fuse F2701 in the receiver power supply protects both the receiver and receiver power supply. From the fuse, power is applied to a network containing two parallel branches. The first branch contains the receiver crystal oven, E31; the receiver crystal oven receives its power through filter choke L40 and maintains the first high-frequency oscillator crystal at a constant temperature in order to stabilize its frequency. The second branch contains the receiver 6.3-volt tube filaments, V1 and V122, POWER indicator lamp I 1501, and transformer T2701. Power for I 1501 is applied through the receiver, equipment cabinet, and control unit. Indicator lamp I 1501 indicates that power is applied to the low- and high-voltage circuits in the receiver and to the crystal oven in the transmitter. Under certain conditions (*c* below), I 1501 also may indicate that reduced power is applied to the transmitter filaments. Voltages for the 1.4-volt receiver filaments and the receiver B+ and bias supplies are developed by secondary windings of transformer T2701 in the receiver power supply. For details on the receiver filament, B+, and bias circuits, see the receiver main schematics (fig. 67) or the instruction book for Radio Receiver R–394/U.

c. Transmitter Power Circuits. In the transmitter, the crystal oven is heated as in the receiver (second circuit to right of the contacts of relay K1203 in (fig. 47)). If a jumper is connected from terminal 6 of relay K1201 to resistor R1202 (fourth circuit to right of the contacts of relay K1203), the transmitter tube filaments will operate continuously, at reduced voltage, as long as the power switch is on. Power is applied to the filaments through the jumper, voltage-dropping resistors R1202 and R1201, voltage regulator tubes RT1201 and RT1202, and choke L1201 in the transmitter power supply, and through the equipment cabinet. The same power that is applied to the filaments also is applied to FREQ 1–2 switch S1503 in the control unit. This switch selects one of two preset transmitter frequencies by controlling the application of filament power to transmitter oscillators V401 and V402. Up to this point, the receiver has been placed in operation, the transmitter tubes are heated (if a jumper is connected correctly in the transmitter power supply as indicated above), and the transmitter crystal oven is operating. The radio set is in a receiving condition, and the transmitter is in a standby condition (push-to-talk switch open).

d. Methods of Transmitter Control. There are two switches and a relay that can initiate the changeover from reception to transmission. They are the push-to-talk switch on the handset, the TEST-OFF switch (S402) on the transmitter, and relay K271 in the receiver. The push-to-talk switch normally is used for routine operation. The TEST switch is used during tuning or alinement, when the transmitter is to be kept on for some time; this eliminates the necessity for holding the push-to-talk switch closed. The third method used to place the transmitter in operation is by relay K271 located in a relay plug-in unit that may be plugged into the receiver. This relay is operated by the squelch circuit of the receiver and, when properly adjusted, will close when the receiver is unsquelched (during reception of a signal). This method normally is used only for retransmission purposes. Jumper connections must be made in the equipment cabinet and receiver in order to use this type of operation (par. 27*e*).

e. Transmitter Control Circuits. Upon closing the push-to-talk switch, TEST-OFF switch, or K271 relay contacts (third circuit to right of the contacts of relay K1203 in fig. 47), the ground circuit to the coil of relay K1201 is completed and K1201 is energized. This connects power to the transmitter tube filaments through contacts 2 and 7 of the relay, and places the filaments in operation. They now will operate at full voltage. Three circuits are energized through contacts 5 and 6 of the relay. The first circuit contains relay K401 (located in the transmitter) that changes the antenna from the receiver to the transmitter. The second circuit contains TRANSMIT lamp I 1502, located on the control unit, to indicate that power is applied to the transmitter. Contactor K1202, in the third circuit, is energized and connects the vehicular storage battery to the motor section of the dynamotor. The generator section of the dynamotor develops 405 volts that are applied across a voltage divider. The voltages produced by the divider are applied to the transmitter as B+ and bias voltages. For details on the B+ and bias circuits, see the transmitter main schematic (fig. 68) or the instruction book for Radio Transmitter T–278/U. Since all of the filament, bias, and B+ voltages now are applied to the transmitter, it will operate until the push-to-talk switch is released. The mute contacts (3 and 4) of the relay can be connected into the circuit to silence the receiver if noise or leakage signal from the transmitter is present. The details of this circuit are given in paragraph 68.

70. Radio Set AN/VRC–19X Power and Control Circuits (12-Volt Operation)

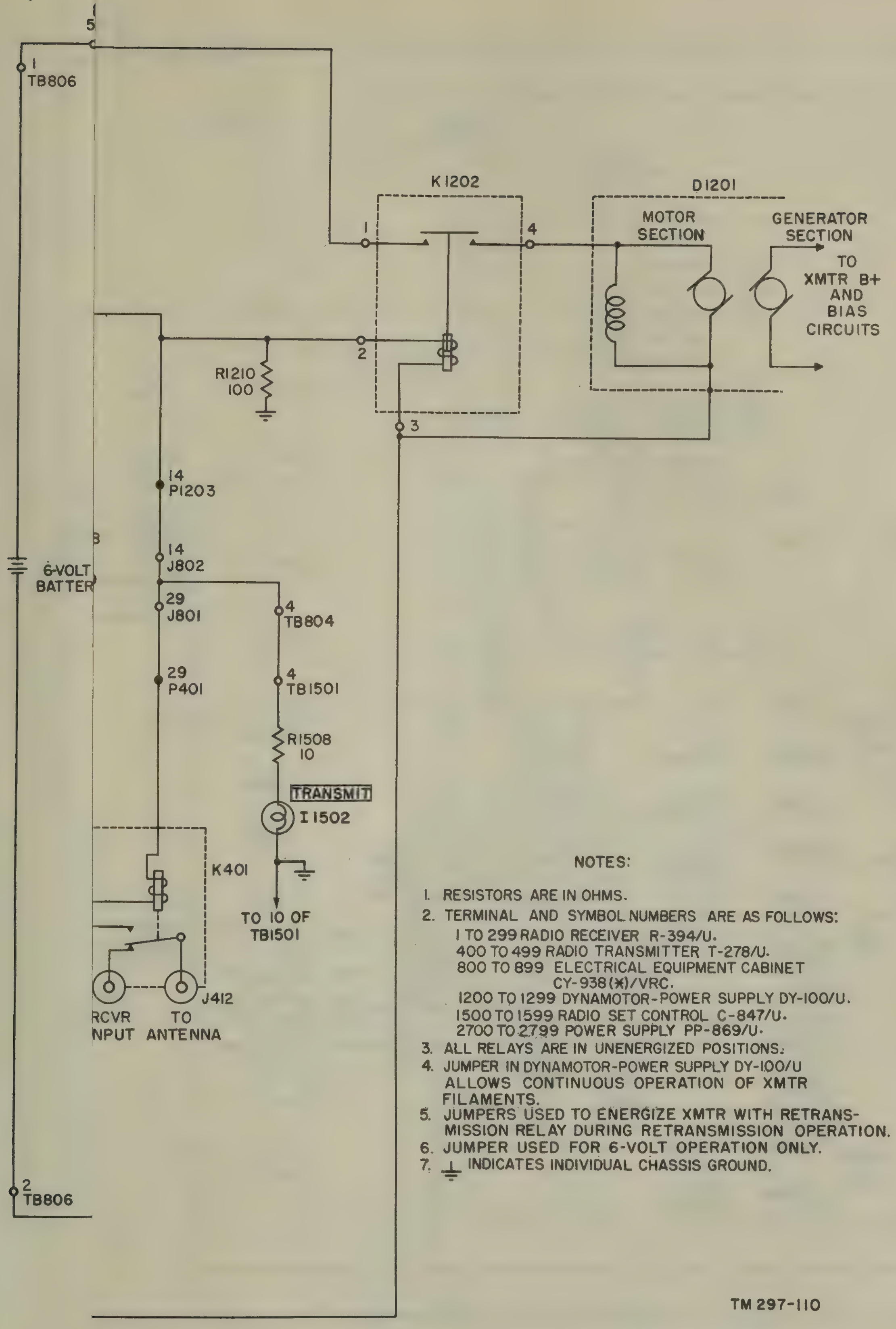
a. The power and control circuits of the 12-volt model of the radio set (fig. 48) are almost identical in operation and connection with that of the 6-volt model. The differences between the models are required to reduce the source voltage (12 volts) to the voltage of the basic circuit (6 volts). A comparison of figures 47 and 48 will show the differences between the two radio sets. These differences are described in *b* below.

b. The transmitter oven voltage is dropped 6 volts by resistor R3113. The transmitter tube filaments are kept at their rated voltage by the insertion of resistor R3115. The coils of relays K3101 and K3103 and contactor K3102 are made for 12 volts so that they operate directly from the source voltage without dropping resistors. Power for the receiver crystal oven, 6.3-volt tube filaments, and the POWER indicator lamp is supplied by a secondary winding of transformer T2801 instead of directly from the power source. Note that the jumper between the power switch and the coil of relay K3103 is connected between terminals 3 and 4 of TB802 instead of between terminals 1 and 2 of TB803 as in the 6-volt model. This was done to prevent damage to the equipment if a 6-volt power supply is used with a 12-volt vehicular system. In operation, the switching and control actions are the same as indicated for the 6-volt model.

71. Radio Set ANV/RC–19 Power and Control Circuits (24-Volt Operation)

a. The low-voltage circuits of Radio Set AN/VRC–19 are not the same as those used in the other two models but are similar in many respects. In the 24-volt model (fig. 49), a relay is not needed to control the input to the receiver and other control relays, since the set requires much less current although it has the same power input as the other two models. Power switch S1501B in Radio Set Control C–847/U has sufficient current-carrying capacity to handle all the circuits except the dynamotor input. Note that a jumper is connected between terminals 2 and 3 of TB803 (near the right side of the power switch) instead of between terminals 1 and 2 of TB803 or terminals 3 and 4 of TB802 which are used in the other two sets. This connection makes it possible to use the power switch for the circuits that were connected to either relay K3103 or K1203 in the other two sets.

b. The heaters for crystal ovens E31 and E401 are operated directly from the 24-volt source. These ovens have elements that are capable of operating on either 6 or 24 volts if properly connected. The connections are made automatically when the correct power supplies are plugged into the system. In the transmitter, all the tube filaments receive their voltages from the secondary windings of power transformer T1301 instead of directly from the power source. The voltage developed in one secondary winding is applied directly to the 6.3-volt filaments; the voltage developed in the other secondary winding is rectified and filtered before it is applied to the 1.3-volt filaments. A fuse, F1301, is provided for dynamotor D1301. Operation of the relays and switches is similar to the operation of equivalent relays and switches in the 6- and 12-volt models.



NOTES:

1. RESISTORS ARE IN OHMS.
2. TERMINAL AND SYMBOL NUMBERS ARE AS FOLLOWS:
   - 1 TO 299 RADIO RECEIVER R-394/U.
   - 400 TO 499 RADIO TRANSMITTER T-278/U.
   - 800 TO 899 ELECTRICAL EQUIPMENT CABINET CY-938(✱)/VRC.
   - 1200 TO 1299 DYNAMOTOR-POWER SUPPLY DY-100/U.
   - 1500 TO 1599 RADIO SET CONTROL C-847/U.
   - 2700 TO 2799 POWER SUPPLY PP-869/U.
3. ALL RELAYS ARE IN UNENERGIZED POSITIONS.
4. JUMPER IN DYNAMOTOR-POWER SUPPLY DY-100/U ALLOWS CONTINUOUS OPERATION OF XMTR FILAMENTS.
5. JUMPERS USED TO ENERGIZE XMTR WITH RETRANSMISSION RELAY DURING RETRANSMISSION OPERATION.
6. JUMPER USED FOR 6-VOLT OPERATION ONLY.
7. ⏚ INDICATES INDIVIDUAL CHASSIS GROUND.

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70. Radio Set AN/VRC-19X Power and Control Circuits (12-Volt Operation)

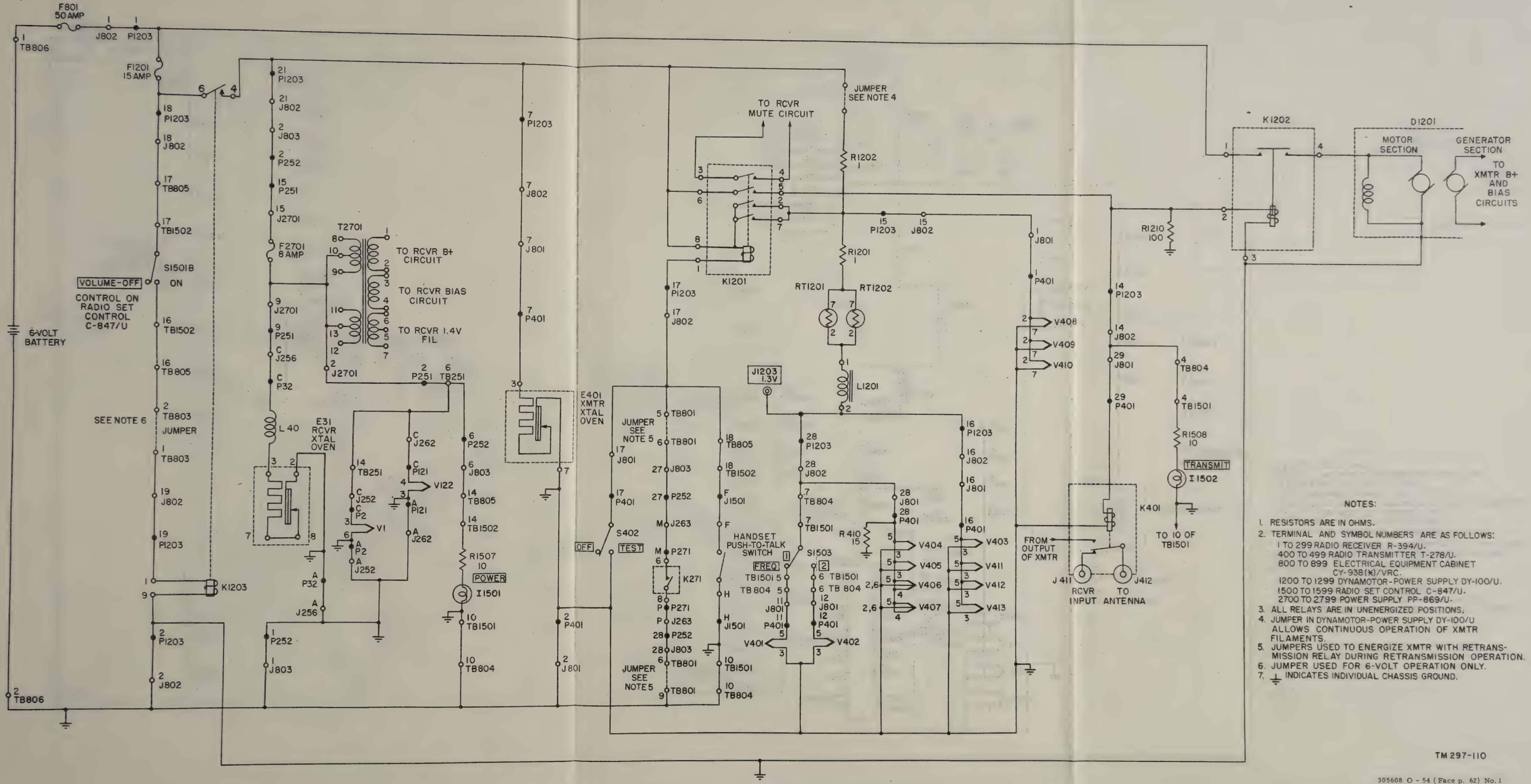
a. The power and control circuits of the 12-volt model of the radio set (fig. 48) are almost identical in operation and connection with that of the 6-volt model. The differences between the models are required to reduce the source voltage (12 volts) to the voltage of the basic circuit (6 volts). A comparison of figures 47 and 48 will show the differences between the two radio sets. These differences are described in *b* below.

b. The transmitter oven voltage is dropped 6 volts by resistor R3113. The transmitter tube filaments are kept at their rated voltage by the insertion of resistor R3115. The coils of relays K3101 and K3103 and contactor K3102 are made for 12 volts so that they operate directly from the source voltage without dropping resistors. Power for the receiver crystal oven, 6.3-volt tube filaments, and the POWER indicator lamp is supplied by a secondary winding of transformer T2801 instead of directly from the power source. Note that the jumper between the power switch and the coil of relay K3103 is connected between terminals 3 and 4 of TB802 instead of between terminals 1 and 2 of TB803 as in the 6-volt model. This was done to prevent damage to the equipment if a 6-volt power supply is used with a 12-volt vehicular system. In operation, the switching and control actions are the same as indicated for the 6-volt model.

71. Radio Set ANV/RC-19 Power and Control Circuits (24-Volt Operation)

a. The low-voltage circuits of Radio Set AN/VRC-19 are not the same as those used in the other two models but are similar in many respects. In the 24-volt model (fig. 49), a relay is not needed to control the input to the receiver and other control relays, since the set requires much less current although it has the same power input as the other two models. Power switch S1501B in Radio Set Control C-847/U has sufficient current-carrying capacity to handle all the circuits except the dynamotor input. Note that a jumper is connected between terminals 2 and 3 of TB803 (near the right side of the power switch) instead of between terminals 1 and 2 of TB803 or terminals 3 and 4 of TB802 which are used in the other two sets. This connection makes it possible to use the power switch for the circuits that were connected to either relay K3103 or K1203 in the other two sets.

b. The heaters for crystal ovens E31 and E401 are operated directly from the 24-volt source. These ovens have elements that are capable of operating on either 6 or 24 volts if properly connected. The connections are made automatically when the correct power supplies are plugged into the system. In the transmitter, all the tube filaments receive their voltages from the secondary windings of power transformer T1301 instead of directly from the power source. The voltage developed in one secondary winding is applied directly to the 6.3-volt filaments; the voltage developed in the other secondary winding is rectified and filtered before it is applied to the 1.3-volt filaments. A fuse, F1301, is provided for dynamotor D1301. Operation of the relays and switches is similar to the operation of equivalent relays and switches in the 6- and 12-volt models.



NOTES:

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    - 1 TO 299 RADIO RECEIVER R-394/U.
    - 400 TO 499 RADIO TRANSMITTER T-278/U.
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    - 1200 TO 1299 DYNAMOTOR-POWER SUPPLY DY-100/U.
    - 1500 TO 1599 RADIO SET CONTROL C-847/U.
    - 2700 TO 2799 POWER SUPPLY PP-869/U.
3. ALL RELAYS ARE IN UNENERGIZED POSITIONS.
4. JUMPER IN DYNAMOTOR-POWER SUPPLY DY-100/U ALLOWS CONTINUOUS OPERATION OF XMTR FILAMENTS.
5. JUMPERS USED TO ENERGIZE XMTR WITH RETRANSMISSION RELAY DURING RETRANSMISSION OPERATION.
6. JUMPER USED FOR 6-VOLT OPERATION ONLY.
7. ⏚ INDICATES INDIVIDUAL CHASSIS GROUND.

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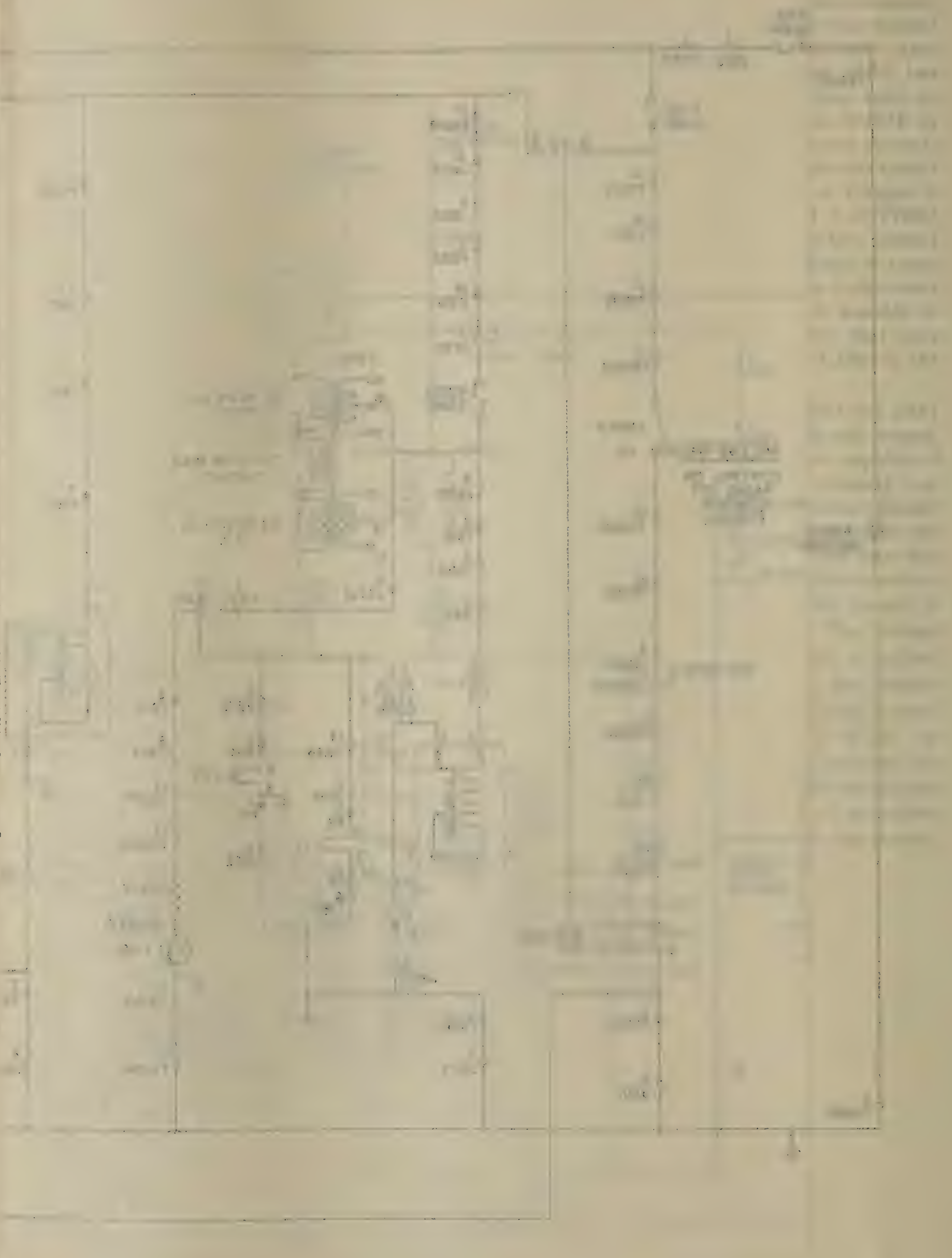
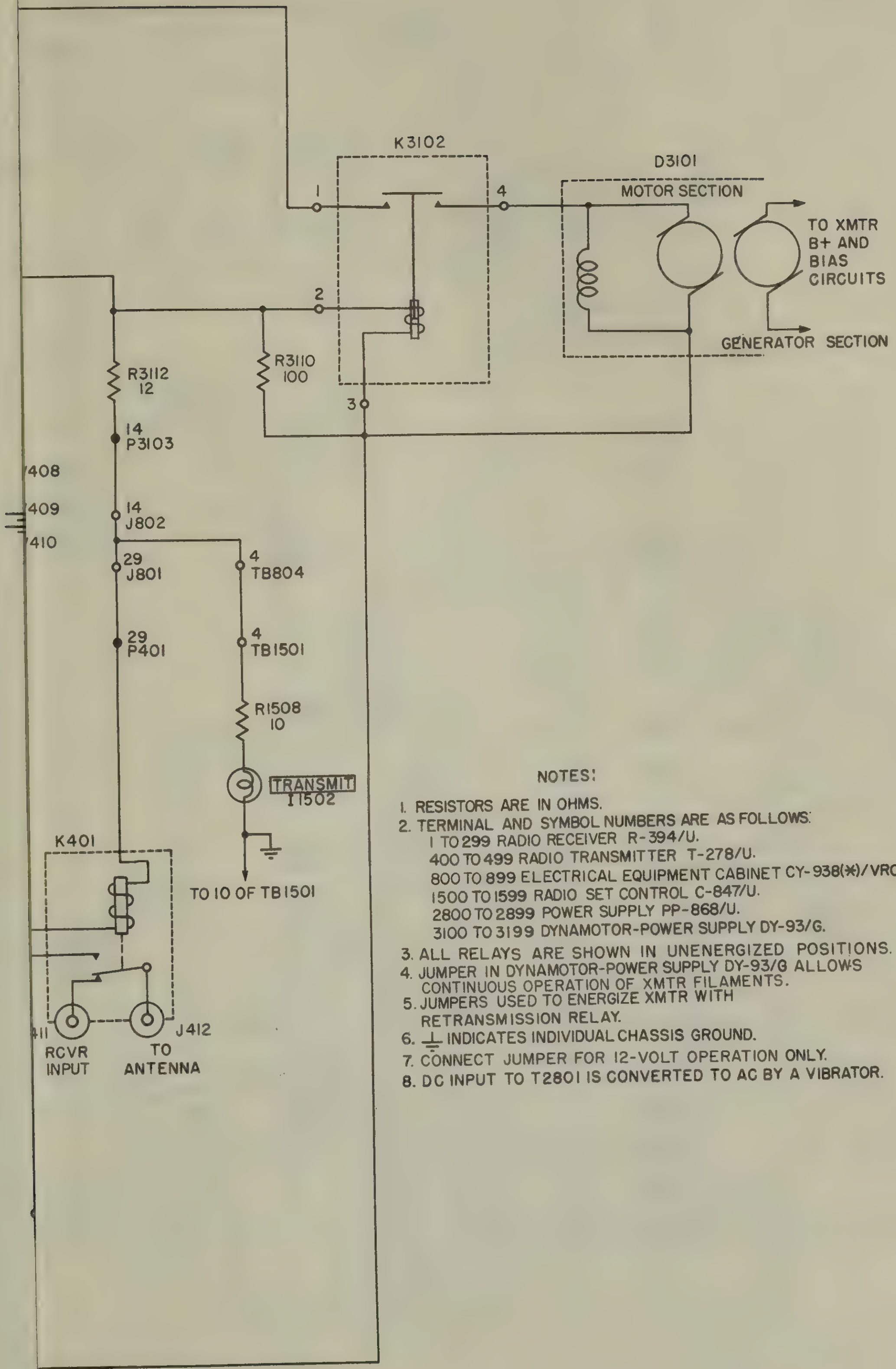
Figure 47. Radio set AN/VRC–194, power and control circuits.





NOTES:

1. RESISTORS ARE IN OHMS.
2. TERMINAL AND SYMBOL NUMBERS ARE AS FOLLOWS:
   1 TO 299 RADIO RECEIVER R-394/U.
   400 TO 499 RADIO TRANSMITTER T-278/U.
   800 TO 899 ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC.
   1500 TO 1599 RADIO SET CONTROL C-847/U.
   2800 TO 2899 POWER SUPPLY PP-868/U.
   3100 TO 3199 DYNAMOTOR-POWER SUPPLY DY-93/G.
3. ALL RELAYS ARE SHOWN IN UNENERGIZED POSITIONS.
4. JUMPER IN DYNAMOTOR-POWER SUPPLY DY-93/G ALLOWS CONTINUOUS OPERATION OF XMTR FILAMENTS.
5. JUMPERS USED TO ENERGIZE XMTR WITH RETRANSMISSION RELAY.
6. ⏚ INDICATES INDIVIDUAL CHASSIS GROUND.
7. CONNECT JUMPER FOR 12-VOLT OPERATION ONLY.
8. DC INPUT TO T2801 IS CONVERTED TO AC BY A VIBRATOR.

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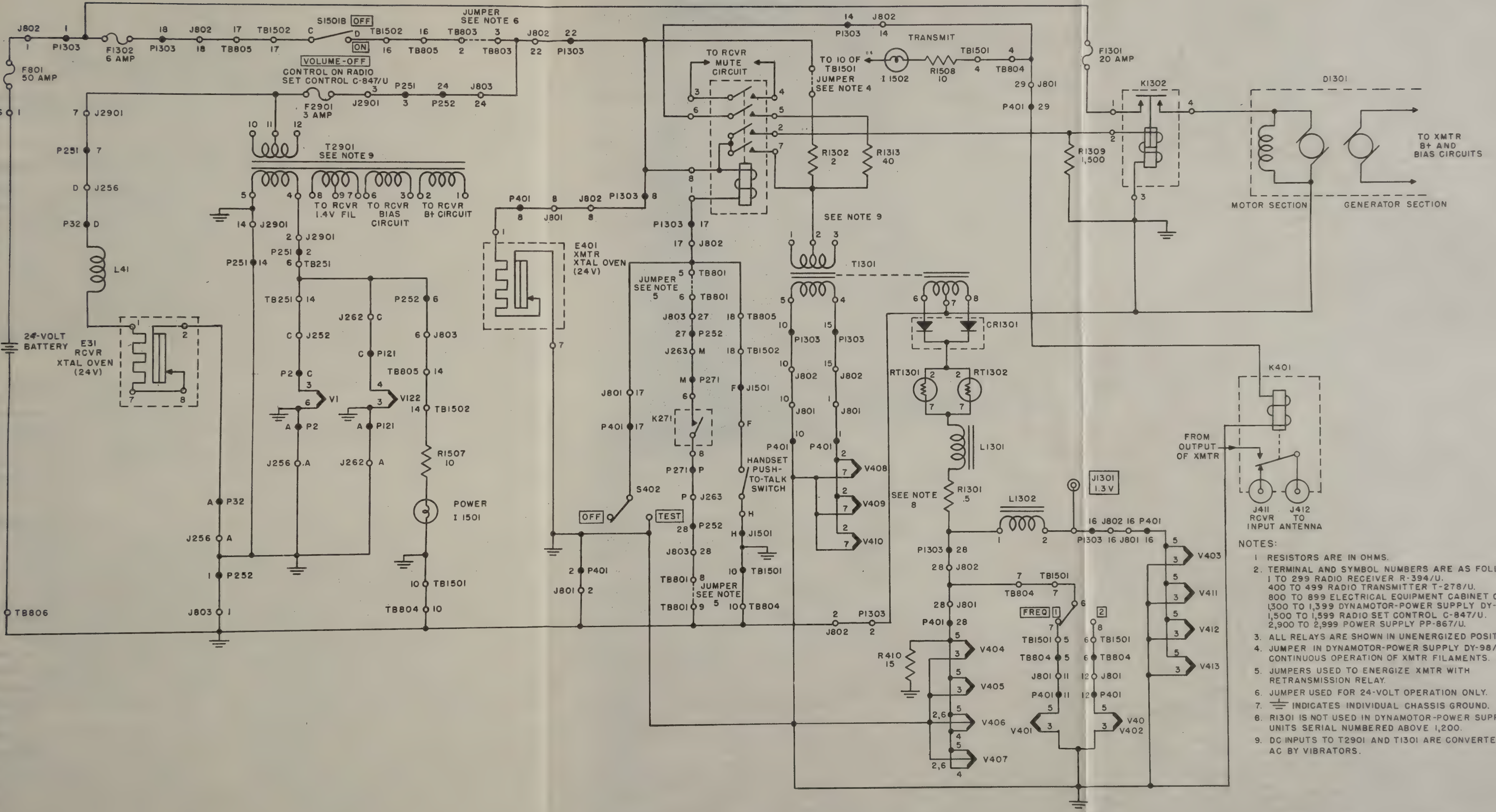
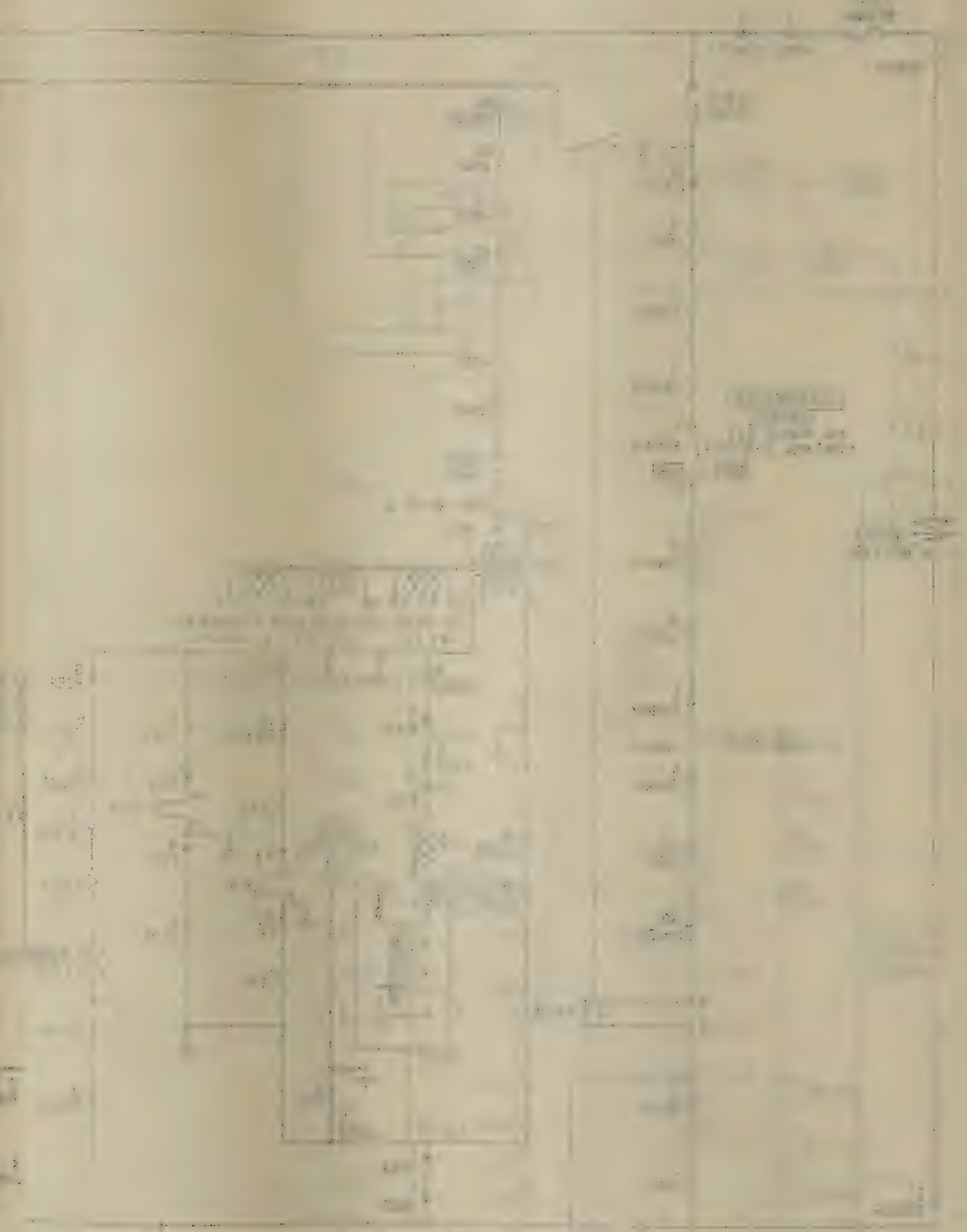
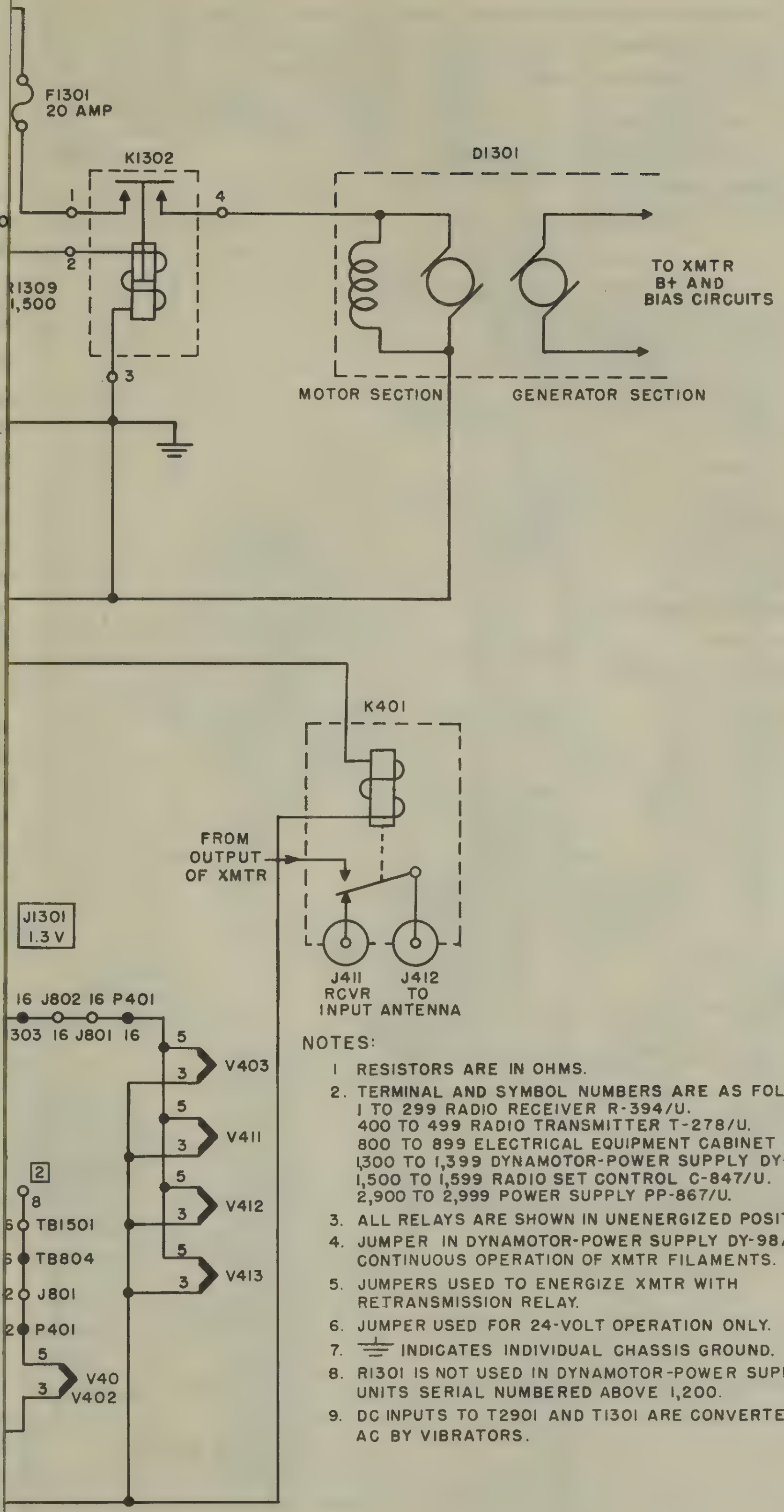


NOTES:

1. RESISTORS ARE IN OHMS.
2. TERMINAL AND SYMBOL NUMBERS ARE AS FOLLOWS:
   1 TO 299 RADIO RECEIVER R-394/U.
   400 TO 499 RADIO TRANSMITTER T-278/U.
   800 TO 899 ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC.
   1,300 TO 1,399 DYNAMOTOR-POWER SUPPLY DY-98/G.
   1,500 TO 1,599 RADIO SET CONTROL C-847/U.
   2,900 TO 2,999 POWER SUPPLY PP-867/U.
3. ALL RELAYS ARE SHOWN IN UNENERGIZED POSITIONS.
4. JUMPER IN DYNAMOTOR-POWER SUPPLY DY-98/G ALLOWS CONTINUOUS OPERATION OF XMTR FILAMENTS.
5. JUMPERS USED TO ENERGIZE XMTR WITH RETRANSMISSION RELAY.
6. JUMPER USED FOR 24-VOLT OPERATION ONLY.
7. ⏚ INDICATES INDIVIDUAL CHASSIS GROUND.
8. R1301 IS NOT USED IN DYNAMOTOR-POWER SUPPLY DY-98/G UNITS SERIAL NUMBERED ABOVE 1,200.
9. DC INPUTS TO T2901 AND T1301 ARE CONVERTED TO AC BY VIBRATORS.

Figure 49. Radio set AN/VRC-19, power and control circuits.





NOTES:

1. RESISTORS ARE IN OHMS.
2. TERMINAL AND SYMBOL NUMBERS ARE AS FOLLOWS:
   1 TO 299 RADIO RECEIVER R-394/U.
   400 TO 499 RADIO TRANSMITTER T-278/U.
   800 TO 899 ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC.
   1,300 TO 1,399 DYNAMOTOR-POWER SUPPLY DY-98/G.
   1,500 TO 1,599 RADIO SET CONTROL C-847/U.
   2,900 TO 2,999 POWER SUPPLY PP-867/U.
3. ALL RELAYS ARE SHOWN IN UNENERGIZED POSITIONS.
4. JUMPER IN DYNAMOTOR-POWER SUPPLY DY-98/G ALLOWS CONTINUOUS OPERATION OF XMTR FILAMENTS.
5. JUMPERS USED TO ENERGIZE XMTR WITH RETRANSMISSION RELAY.
6. JUMPER USED FOR 24-VOLT OPERATION ONLY.
7. ⏚ INDICATES INDIVIDUAL CHASSIS GROUND.
8. R1301 IS NOT USED IN DYNAMOTOR-POWER SUPPLY DY-98/G UNITS SERIAL NUMBERED ABOVE 1,200.
9. DC INPUTS TO T2901 AND T1301 ARE CONVERTED TO AC BY VIBRATORS.

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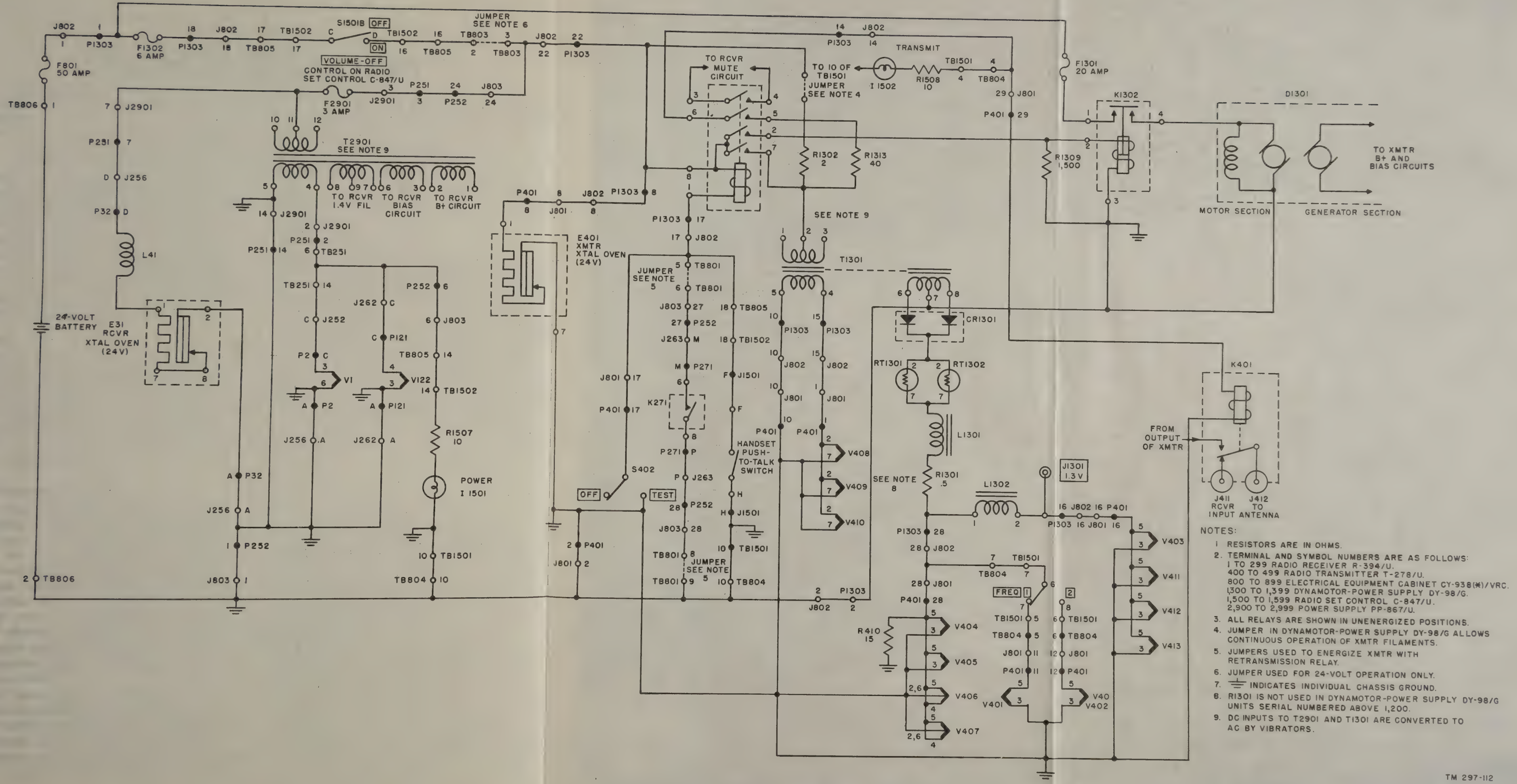

NOTES:

1 RESISTORS ARE IN OHMS.
2. TERMINAL AND SYMBOL NUMBERS ARE AS FOLLOWS:
1 TO 299 RADIO RECEIVER R-394/U.
400 TO 499 RADIO TRANSMITTER T-278/U.
800 TO 899 ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC.
1,300 TO 1,399 DYNAMOTOR-POWER SUPPLY DY-98/G.
1,500 TO 1,599 RADIO SET CONTROL C-847/U.
2,900 TO 2,999 POWER SUPPLY PP-867/U.
3. ALL RELAYS ARE SHOWN IN UNENERGIZED POSITIONS.
4. JUMPER IN DYNAMOTOR-POWER SUPPLY DY-98/G ALLOWS CONTINUOUS OPERATION OF XMTR FILAMENTS.
5. JUMPERS USED TO ENERGIZE XMTR WITH RETRANSMISSION RELAY.
6. JUMPER USED FOR 24-VOLT OPERATION ONLY.
7. ⏚ INDICATES INDIVIDUAL CHASSIS GROUND.
8. R1301 IS NOT USED IN DYNAMOTOR-POWER SUPPLY DY-98/G UNITS SERIAL NUMBERED ABOVE 1,200.
9. DC INPUTS TO T2901 AND T1301 ARE CONVERTED TO AC BY VIBRATORS.

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Figure 49. Radio set AN/VRC-19, power and control circuits.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing Radio Set AN/VRC–19(*), be extremely careful of exposed high voltages. Voltages as high as 400 volts are present at certain points in Radio Transmitter T–278/U and its associated power supply. It is also possible to come in contact with these high voltages when the rear cover of Electrical Equipment Cabinet CY–938(*)/VRC is removed. Be sure that all power is turned off before touching any of the high-voltage connections.

72. General

This chapter contains a general field maintenance procedure for system troubleshooting and detailed field maintenance instructions for Electrical Equipment Cabinet CY–938(*)/VRC and Radio Set Control C–847/U. For detailed information related to the maintenance of the other radio set components, refer to the individual component instruction books.

73. Troubleshooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal conditions. Some faults such as burned-out resistors, rf arcing, and shorted transformers often can be located by sight, smell, or hearing. The majority of faults, however, must be localized by voltage and resistance checks.

Warning: Some of the components of the radio set contain selenium rectifiers. The failure of selenium rectifiers can result in the liberation of poisonous fumes and the deposit of poisonous selenium compounds. If a rectifier burns out or arcs over, the odor is strong. Provide adequate ventilation immediately. *Avoid inhaling the fumes and do not handle the damaged rectifier until it has cooled.*

74. Troubleshooting Data

Take advantage of the material supplied in this manual. It will help in the rapid sectionalization of faults. Diagrams showing the connections of the system, control circuits of the power source, and schematic diagrams of each unit are provided in addition to those that will be found in the individual component instruction books. By tracing the key circuits through switches, terminal boards, and cables, troubles usually can be found very readily. During the troubleshooting procedures, it may be helpful to consult chapter 4 for the theory of circuit operations in order to locate the trouble more rapidly and to prevent unnecessary work.

Fig. No.	Description
21	Radio Set AN/VRC–19(*), connections.
23	Radio Transmitter T–278/U, front panel.
24	Radio Receiver R–394/U, front panel test points.
25	Typical transmitter power supply, front panel test points.
28	Electrical Equipment Cabinet CY–938/VRC, interior view.
29	Radio Transmitter T–278/U, tube location.
30	Transmitter power supply fuse, relay, regulator, and vibrator location.
31	Radio Receiver R–394/U, tube location.
32	Receiver power supply fuse and vibrator location.
40	Radio Set Control C–847/U, schematic diagram.
41	Handset H–33/PT, schematic diagram.
47	Radio Set AN/VRC–19Y, power and control circuits.
48	Radio Set AN/VRC–19X, power and control circuits.
49	Radio Set AN/VRC–19, power and control circuits.
58	Electrical Equipment Cabinet CY–938(*)/VRC, schematic diagram.

Fig. No.	Description
59	Resistor color codes.
60	Capacitor color codes.
61	Dynamotor-Power Supply DY–100/U, schematic diagram.
62	Dynamotor-Power Supply DY–93/G, schematic diagram.
63	Dynamotor-Power Supply DY–98/G, schematic diagram.
64	Power Supply PP–869/U, schematic diagram.
65	Power Supply PP–868/U, schematic diagram.
66	Power Supply PP–867/U, schematic diagram.
67	Radio Receiver R–394/U, schematic diagram.
68	Radio Transmitter T–278/U, schematic diagram.
69	Electrical Equipment Cabinet CY–938(*)/VRC, wiring diagram.
70	Electrical Equipment Cabinet CY–938(*)/VRC, voltage and resistance diagram.

75. Troubleshooting Chart for Radio Set AN/VRC–19(*)

Symptom	Probable cause	Correction
1. Entire set fails to operate	Electrical Equipment Cabinet CY–938(*)/VRC. Radio Set Control C–847/U. Transmitter power supply.	Refer to paragraph 76*a*.
2. Transmitter operates on frequency 2 only.	Radio Set Control C–847/U Control cable. Electrical Equipment Cabinet CY–938(*)/VRC.	Refer to paragraph 76*b*.
	Radio Transmitter T–278/U	Refer to the instruction book for Radio Transmitter T–278/U and check the transmitter oscillator circuits.
3. Transmitter operates on frequency 1 only.	Radio Set Control C–847/U Control cable. Electrical Equipment Cabinet CY–938(*)/VRC.	Refer to paragraph 76*c*.
	Radio Transmitter T–278/U	Refer to the instruction book for Radio Transmitter T–278/U and check the transmitter oscillator circuits.
4. Transmitter operates when TEST-OFF switch is in the TEST position, but will not operate when the push-to-talk switch is pressed.	Electrical Equipment Cabinet CY–938(*)/VRC. Control cable. Radio Set Control C–847/U.	Refer to paragraph 76*d*.
	Handset H–33/PT	Substitute with another handset.
5. Transmitter operates when the push-to-talk switch or the handset is pressed, but will not operate when the transmitter TEST-OFF switch is in the TEST position.	Electrical Equipment Cabinet CY–938(*)/VRC.	Refer to paragraph 76*e*.
	Radio Transmitter T–278/U	Refer to the instruction book for Radio Transmitter T–278/U.
6. Transmitter will not operate when used for retransmission purposes.	Electrical Equipment Cabinet CY–938(*)/VRC.	Refer to paragraph 76*f*.
	Improper antenna or jumper connections.	Refer to paragraph 37 for proper antenna and jumper connections.
	Receiver relay K271	Replace relay K271.
7. Transmitter operates but receiver does not operate.	Receiver Power Supply	Refer to paragraph 76*g*(1).
	Electrical Equipment Cabinet CY–938(*)/VRC.	Refer to paragraph 76*g*(2).
	Radio Receiver R–394/U	Refer to the receiver instruction book.

Symptom	Probable cause	Correction
8. Receiver operates but transmitter does not operate.	Transmitter power supply	Refer to the instruction book for the transmitter power supplies and check the output voltage.
	Electrical Equipment Cabinet CY–938(*)/VRC. Radio Set Control C–847/U.	Refer to paragraph 76*h*.
	Radio Transmitter T–278/U	Refer to the transmitter instruction book.
9. Receiver will not squelch	Electrical Equipment Cabinet CY–938(*)/VRC. Control cable. Radio Set Control C–847/U.	Refer to paragraph 76*i*.
10. TRANSMIT lamp does not light	Radio Set Control C–847/U Electrical Equipment Cabinet CY–938(*)/VRC.	Refer to paragraph 76*j*.
11. POWER lamp does not light	Electrical Equipment Cabinet CY–938(*)/VRC. Radio Set Control C–847/U.	Refer to paragraph 76*k*.

76. Resistance and Voltage Measurements for Radio Set AN/VRC–19(*)

Follow the steps given in the starting procedure (par. 35) before making voltage measurements on Radio Set AN/VRC–19(*). The push-to-talk relay (K1201, K1301, or K3101) must be energized to apply operating voltages to the transmitter. This may be done by pressing the push-to-talk switch on the handset or placing the TEST-OFF switch on the transmitter in the TEST position. For resistance or continuity measurements, it is necessary to disconnect the power source (battery) from the set. Refer to the diagrams for power and control circuits (figs. 47, 48, and 49) and to the voltage and resistance diagram (fig. 70) when making these measurements. Replace any components found to be defective. All voltages are measured to ground. The series of symbol numbers for the various units are as follows:

From	To	Unit
1	299	Radio Receiver R–394/U.
400	499	Radio Transmitter T–278/U.
800	899	Electrical Equipment Cabinet CY–938(*)/VRC.
1200	1299	Dynamotor-Power Supply DY–100/U.
1300	1399	Dynamotor-Power Supply DY–98/G.
3100	3199	Dynamotor-Power Supply DY–93/G.
1500	1599	Radio Set Control C–847/U.
2700	2799	Power Supply PP–869/U.
2800	2899	Power Supply PP–868/U.
2900	2999	Power Supply PP–867/U.

a. If the radio set is completely inoperative, make the following checks:

(1) Check the power source (6-, 12-, or 24-volt battery).

(2) Check for proper input voltage between terminals 1 and 2 of TB806. Check fuse F801 by measuring for proper voltage between terminal 1 of J802 and ground (fig. 21).

(3) Check transmitter power supply fuse F1201, F3101, or F1302 (6-, 12-, or 24-volt systems, respectively) by measuring for proper voltage in the equipment cabinet between terminal 18 of J802 and ground.

(4) Check power switch, S1501B, and the control cable by measuring for proper voltage in the equipment cabinet between terminal 16 of TB805 and ground.

(5) Check the equipment cabinet jumper connections between terminals 1 and 2 of TB803 (6-volt system), terminals 3 and 4 of TB802 (12-volt system), or terminals 2 and 3 of TB803 (24-volt system).

(6) On the 6-volt system, check for 6 volts on terminal 2 of J803.

(7) On the 12-volt system, check for 12 volts on terminal 19 of J803.

(8) On the 24-volt system, check for 24 volts on terminal 22 of J802.

b. If the transmitter operates when the FREQ 1–2 switch on the control unit is set to position

2 but will not operate when set to position 1, make the following checks:

- (1) Disconnect the control cable from terminal 5 of TB1501, and check the cable for continuity to terminal 5 of TB804.
- (2) Check in the equipment cabinet for continuity between terminal 5 of TB804 and terminal 11 of J801.
- (3) Check in the control unit for continuity between terminals 5 and 7 of TB1501 with the FREQ 1–2 switch in position 1.
- (4) Set the FREQ 1–2 switch on the control unit to position 1, and check for a 1.3-volt reading on each of the following terminals:
  - (*a*) Terminal 5 of TB1501.
  - (*b*) Terminal 5 of TB804.
  - (*c*) Terminal 11 of J801.

c. If the transmitter operates when the FREQ 1–2 switch is set to position 1 but will not operate when set to position 2, make the following checks:

- (1) Disconnect the control cable from terminal 6 of TB1501, and check the cable for continuity to terminal 6 of TB804.
- (2) Check in the equipment cabinet for continuity between terminal 6 of TB804 and terminal 12 of J801.
- (3) Check in the control unit for continuity between terminals 6 and 7 of TB1501 with the FREQ 1–2 switch in position 2.
- (4) Set the FREQ 1–2 switch on the control unit to position 2, and check for a 1.3-volt reading on each of the following terminals:
  - (*a*) Terminal 6 of TB1501.
  - (*b*) Terminal 6 of TB804.
  - (*c*) Terminal 12 of J801.

d. If the transmitter operates when the TEST-OFF switch is in the TEST position but will not operate when the push-to-talk switch is pressed, press the switch and check for continuity from terminal 17 of J802 to each of the following terminals:

- (1) Terminal 18 of TB805.
- (2) Terminal 18 of TB1502.
- (3) Terminal F of J1501.
- (4) Terminal H of J1501.
- (5) Terminal 10 of TB1501.
- (6) Terminal 10 of TB804.
- (7) Terminal 2 of J802.

e. If the transmitter operates when the push-to-talk switch is pressed but will not operate when the TEST-OFF switch is in the TEST position, place the TEST-OFF switch in the TEST position and check for continuity from terminal 17 of J802 to each of the following terminals:

- (1) Terminal 17 of J801.
- (2) Terminal 2 of J801.

f. If the transmitter will not operate when used for retransmission purposes, be sure jumpers are connected from terminal 5 to terminal 6 of TB801 and from terminal 8 to terminal 9 of TB801.

- (1) Check for continuity from terminal 17 of J802 to each of the following terminals:
  - (*a*) Terminal 5 of TB801.
  - (*b*) Terminal 6 of TB801.
  - (*c*) Terminal 27 of J803.
- (2) Check for continuity from terminal 28 of J803 to each of the following terminals:
  - (*a*) Terminal 8 of TB801.
  - (*b*) Terminal 9 of TB801.
  - (*c*) Terminal 2 of J802.

g. If the transmitter operates but the receiver will not operate, make the following checks:

- (1) Check the receiver power supply fuse F2701, F2801, or F2901 (6-, 12-, 24-volt systems respectively).
- (2) Check the antenna connections to the equipment cabinet (P801) and antenna connections in the equipment cabinet between the transmitter (terminal A 1 of J801) and receiver (terminal A 2 of J803). Check continuity between terminals A 1 and A 2.

h. If the receiver operates but the transmitter will not operate, make the following checks:

- (1) Check for a 6-volt reading on each of the following terminals:
  - (*a*) Terminal 14 of J802.
  - (*b*) Terminal 29 of J801.
- (2) Check for a 1.3-volt reading on each of the following terminals:
  - (*a*) Terminals 16 and 28 of J802.
  - (*b*) Terminals 16 and 28 of J801.
  - (*c*) Terminal 7 of TB804.
  - (*d*) Terminal 7 of TB1501.

i. If the receiver will not squelch, make the following checks:

- (1) Check the resistance of the SQUELCH control between terminal 8 of TB804 in the equipment cabinet and ground. The resistance should vary from zero to 500,000 ohms as the control is rotated.
- (2) Remove the control cable wires from terminals 8, 9, and 10 of TB1501, and check for continuity between each wire

and its termination on TB805 in the equipment cabinet (terminals 8, 9, and 10, respectively).

(3) Check for proper connections on terminals 8, 9, and 10 of TB1501 and TB805.

j. If the TRANSMIT lamp does not light when the push-to-talk switch is depressed, make the following checks:

(1) Check the TRANSMIT lamp by substituting a lamp known to be good.

(2) Check for a 6-volt reading on each of the following terminals:
- (*a*) Terminal 4 of TB804.
- (*b*) Terminal 4 of TB1501.

(3) Check R1508. Check for continuity from terminal 10 of TB1501 to each of the following terminals:
- (*a*) Terminal 10 of TB804.
- (*b*) Terminal 2 of J802.

k. If the POWER lamp does not light when the power switch (S1501B) is turned on, make the following checks:

(1) Check for continuity from terminal 6 of J803 to each of the following terminals:
- (*a*) Terminal 14 of TB805.
- (*b*) Terminal 14 of TB1502.

(2) Check R1507 and I 1501. Check for continuity from terminal 10 of TB1501 to each of the following terminals:
- (*a*) Terminal 10 of TB804.
- (*b*) Terminal 2 of J802.

Section II. TROUBLESHOOTING RADIO SET CONTROL C–847/U AND ELECTRICAL EQUIPMENT CABINET CY–938(*)/VRC

77. Test Equipment Required

Electronic Multimeter TS–505/U can be used for troubleshooting Radio Set Control C–847/U and Electrical Equipment Cabinet CY–938(*)/VRC. Instructions for the use of this meter are contained in TM 11–5511, Electronic Multimeter TS–505/U.

78. Localizing Trouble

After the trouble has been sectionalized to the control unit or the equipment cabinet, the defective item can be determined from the troubleshooting charts (pars. 79 and 80). Check to see that all cable connections from the control unit to the equipment cabinet are correct and that all control settings are in the proper position for normal operation. When checking the possible defective item listed in the troubleshooting chart, always check for defective wiring. Refer to figures 28, 50, and 51 for identification of the components.

79. Resistance Measurements in Radio Set Control C–847/U

Resistance measurements in Radio Set Control C–847/U are taken across the terminals of terminal boards TB1501 and TB1502. To take these measurements, the control cable must be disconnected from the terminal boards. The measurements are given for groups of terminals in the same circuit, thereby indicating the readings to be expected for each control circuit if it is functioning properly. Be sure to set the controls as shown in the following chart. Refer to figure 50 for the location of the terminal boards.

Terminals measured	Related control or part	Position	Reading (ohms)
19 to 20	Handset H–33/PT	Disconnected	Infinity.
10 to 14	POWER lamp I 1501	In socket	35.
16 to 17, 13 to 15	VOLUME-OFF switch S1501	Any position except OFF	0.
4 to 10	TRANSMIT lamp I 1502	In socket	35.
10 to 18	Handset H–33/PT	Disconnected	Infinity.
9 to 10	SQUELCH control S1504 and R1509	OFF	0.
8 to 10	SQUELCH control S1504 and R1509	Maximum counterclockwise,	0.
		maximum clockwise.	500K.
6 to 7	FREQ 1–2 switch S1503	2	0.
		1	Infinity.
5 to 7	FREQ 1–2 switch S1503	1	0.
		2	Infinity.
11 to 12	VOLUME-OFF S1501	First position from OFF	8.8.
		Second position from OFF	8.
		Third position from OFF	5.5.
1 to 2, 2 to 3	None	None	Infinity.

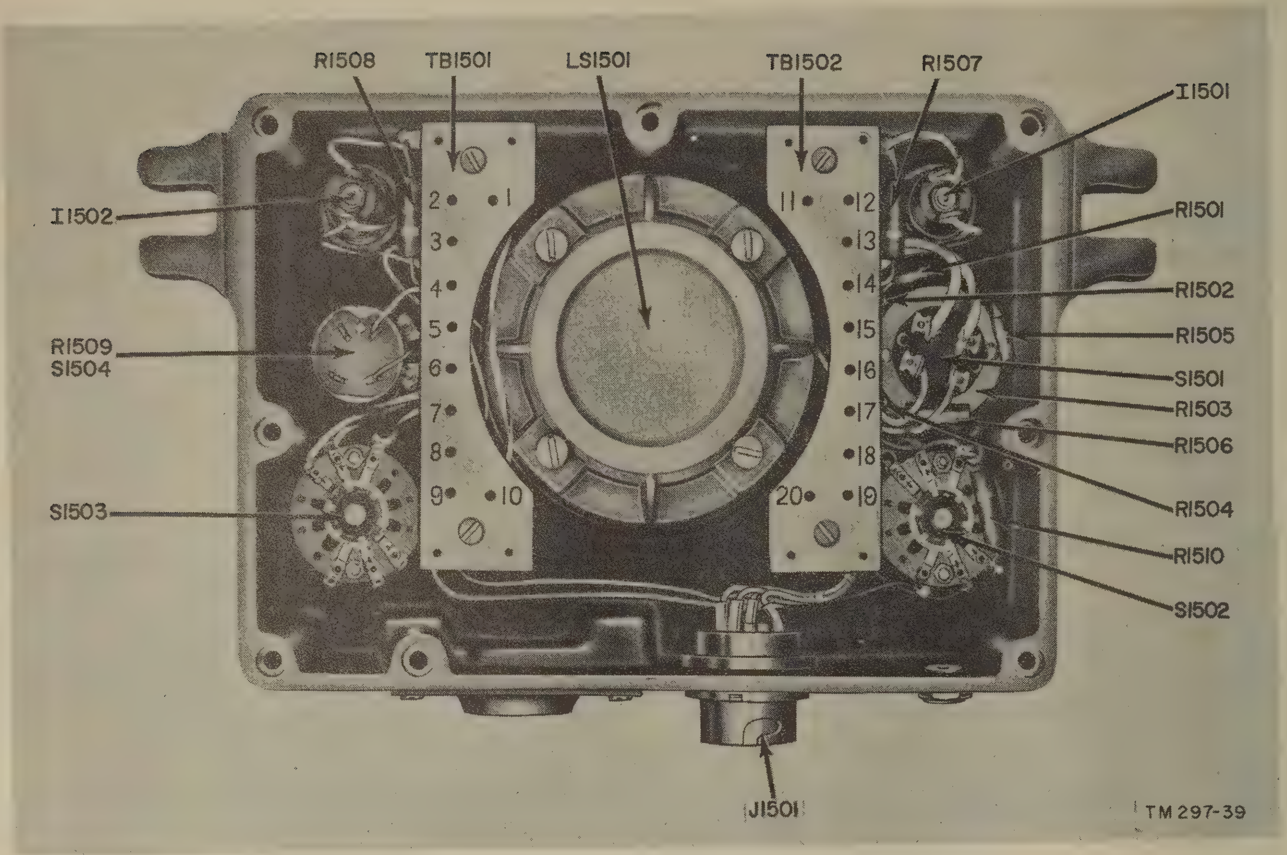


Figure 50. Radio set control C–847/U, rear view with cover removed.

80. Continuity Tests and Resistance Measurements for Electrical Equipment Cabinet CY–938(*)/VRC

The equipment cabinet has no switches or variable parts, therefore, the only troubles that can occur are either short or open circuits. These troubles can be discovered readily and corrected by making continuity checks between the connectors and terminal boards on the rear of the equipment cabinet. Use the lowest resistance range on the ohmmeter for making continuity tests. When troubleshooting the equipment cabinet, refer to the schematic diagram (fig. 58). The receiver, transmitter, and transmitter power supply should be removed from the equipment cabinet for these tests. Also remove all terminal board jumper connections. The tests described below are grouped according to their function in the radio set. Select the group or groups containing the trouble, and perform the continuity or resistance tests as indicated.

Note. Continuity refers to an ohmmeter reading of less than .1 ohm.

a. Filament and Heater Circuits.

Connector	Terminal		Connector	Terminal
J802	10	and	J801	10
J802	15	and	J801	1
J802	28	and	J801	28
J802	28	and	TB804	7
J802	16	and	J801	16

b. Bias and B+ Voltages.

Connector	Terminal		Connector	Terminal
J802	9	and	J801	9
J802	6	and	J801	6
J802	5	and	J801	5
J802	4	and	J801	4
J802	3	and	J801	3
J802	25	and	J801	26
J802	25	and	TB801	4
J802	24	and	J801	27

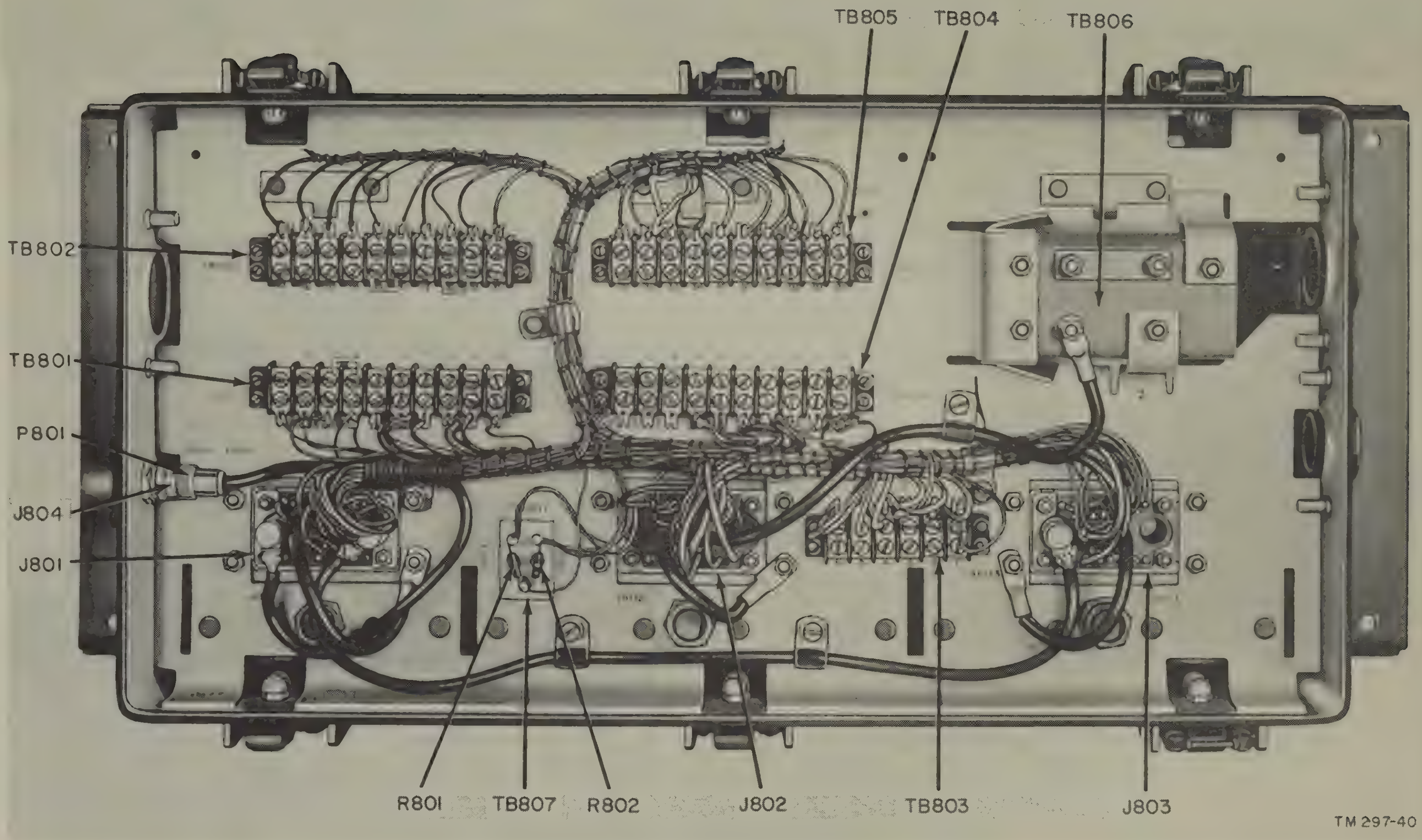


Figure 51. *Electrical equipment cabinet CY–938/VRC, rear view with cover removed.*

c. Ac Power Input.

Connector	Terminal		Connector	Terminal
J802	11	and	J803	3
J802	11	and	TB803	5
J802	12	and	J803	4
J802	12	and	TB803	6
J802	13	and	J803	5
J802	13	and	TB805	13

d. Battery Circuits.

Connector	Terminal		Connector	Terminal
J802	21	and	J803	2
J802	20	and	J803	19
J802	22	and	J803	24
J802	22	and	TB803	3
J802	1	and	TB806	[a] 1
J802	18	and	TB805	17

[a] This test checks continuity through fuse F801.

e. Power Contactor Circuits.

Connector	Terminal		Connector	Terminal
J802	19	and	TB803	1
J802	30	and	TB802	4

f. Push-to-Talk Circuits.

Connector	Terminal		Connector	Terminal
J802	17	and	J801	17
J802	17	and	TB801	5
J802	17	and	TB805	18
J802	14	and	J801	29
J802	14	and	TB804	4

g. Transmitter Crystal Oven Heaters.

Connector	Terminal		Connector	Terminal
J802	7	and	J801	7
J802	8	and	J801	8

h. Transmitter and Receiver Antenna Circuits.

Connector	Terminal		Connector	Terminal
J801	A1	and	J803	A2
J801	A2	and	P801	--------

i. Transmitter Modulator Circuit

Connector	Terminal		Connector	Terminal
J801	13	and	TB805	19
J801	14	and	TB801	10
J801	15	and	TB805	20

j. Transmitter Frequency-Changing Circuit.

Connector	Terminal		Connector	Terminal
J801	11	and	TB804	5
J801	12	and	TB804	6

k. Receiver Relay Circuit.

Connector	Terminal		Connector	Terminal
J803	27	and	TB801	6
J803	28	and	TB801	8
J803	29	and	TB801	7
J803	11	and	TB802	6
J803	12	and	TB802	10
J803	13	and	TB802	2

l. Receiver Squelch Circuit.

Connector	Terminal		Connector	Terminal
J803	8	and	TB804	8
J803	9	and	TB804	9
J803	17	and	TB801	3

m. Receiver Audio-Output Circuit.

Connector	Terminal		Connector	Terminal
J803	14	and	TB805	11
J803	14	and	TB801	2
J803	15	and	TB802	9

n. Receiver Audio-Output Circuit Resistance Measurements.

Connector	Terminal		Connector	Terminal	Resistance
TB801	1	and	TB801	2	680 ohms
TB801	1	and	TB802	9	2,200 ohms
TB801	2	and	TB802	9	2,880 ohms

o. Receiver Pilot and Call Lamp Circuits.

Connector	Terminal		Connector	Terminal
J803	10	and	TB802	1
J803	6	and	TB805	14
J803	6	and	TB802	5

p. Terminal Board Interconnections.

Connector	Terminal		Connector	Terminal
TB802	3	and	TB803	2
TB802	3	and	TB805	16
TB802	8	and	TB805	12
TB803	4	and	TB805	15

q. Ground Connections.

Connection		Connector	Terminal
Chassis ground	and	J801	2
Chassis ground	and	J802	2
Chassis ground	and	J803	1
Chassis ground	and	TB801	9
Chassis ground	and	TB802	7
Chassis ground	and	TB804	10
Chassis ground	and	TB806	2

Section III. REPAIRS

81. Replacement of Parts

a. General. For information concerning the replacement of parts in the transmitter, receiver, or either power supply, consult the specific component instruction book. The descriptions that follow are for replacement of parts in Radio Set Control C–847/U and Electrical Equipment Cabinet CY–938(*)/VRC.

b. Radio Set Control C–847/U (figs. 8 and 50). The indicator lamps can be changed by unscrewing the jewel assembly of the POWER and TRANSMIT sockets from the front panel. Push in the bulb and turn counterclockwise to release it from the socket. To replace, reverse the procedure. Before any of the front panel controls can be removed, the knobs first must be taken from the control shafts. The knobs are held to the shafts by standard screws. Once the knobs are off, use the following procedure for replacing the controls.

(1) Loosen the eight captive screws on the rear cover and remove the cover.

(2) Disconnect all wires from the control to be replaced except those that go from lug to lug on the control. Mark each wire so that it can be reconnected properly when the control is replaced.

(3) Remove the front panel nut that secures the control.

(4) Wire the new control with the jumpers and resistors exactly as the old one was wired.

(5) Mount the control by reversing the procedure in (3) above and connect all the necessary wiring.

(6) Sometimes it may be necessary to reverse the sequence of (2) and (3) above to facilitate disconnection of the wiring.

(7) The pilot lamp sockets are removed in a similar manner.

(8) Each terminal board is secured by two screws.

c. Electrical Equipment Cabinet CY–938(*)/VRC (figs. 28 and 51). The trunk-type latches on the equipment cabinet (on the covers on A models) are held by two screws each. Removal of the screws allows replacement of the latches. Antenna coaxial connector P801 may be disconnected from jack J804 by turning it one-fourth of a turn counterclockwise. To remove the terminal boards or jacks J801, J802, and J803, follow the procedure below:

(1) Unsolder all wiring to the terminal board or jack. Mark each wire so that it can be replaced correctly.

(2) Take out the four screws and remove the board or jack.

(3) Reverse the procedure to replace the boards and jacks.

(4) Make sure all connections are tight, especially the ground connections to the equipment cabinet.

82. Refinishing

Instructions for rustproofing and touchup painting are given in paragraph 50. Instructions for refinishing badly marred surfaces are given in TM 9–2851, Painting Instructions for Field Use.

Section IV. ALINEMENT PROCEDURES

83. General

a. Receiver alinement is more difficult than transmitter alinement, since the receiver must be tuned exactly to a transmitter that may be a considerable distance away. Normally, an accurately calibrated signal generator is used to provide a signal simulating that of the distant transmitter. This provides a signal for a coarse tuning adjustment and the receiver can be tuned to the approximate frequency. After the coarse tuning procedure is completed, it is necessary to *warp* the crystal in the first high-frequency oscillator to assure accurate tuning of the receiver to the desired transmitter frequency. Without the *warping* of the oscillator crystal, reduced range of reception and distortion in the audio output may result.

b. It is necessary, for complete adjustment of either the transmitter or receiver, to remove these components from the equipment cabinet. Connection to the component is made by a patch cord (Electrical Special Purpose Cable Assembly CX–2371/U) that is available as an issued item at the maintenance depot. Access to the receiver tuning adjustments can be obtained through holes in the front of the receiver (fig. 53).

84. Test Instruments Used for Alinement

A vacuum-tube voltmeter (vtvm) and a signal generator are required for receiver alinement; a vtvm and a frequency meter are required for transmitter alinement. The signal generator and frequency meter must be capable of operating within the frequency range of 152 to 174 mc. Use the following test equipment and associated publications:

Test equipment	Publication
Electronic Multimeter TS–505/U or equal.	TM 11–5511.
Multimeter TS–352/U	TM 11–5527.
Frequency Meter TS–174B/U	TM 11–5044.

85. Transmitter Alinement

a. Preliminary Procedure. Before proceeding with the alinement procedure, the following preliminary steps should be taken:

(1) Release the transmitter from the equipment cabinet by turning the hold-in lock counterclockwise. The transmitter then may be pulled out by using the handle located on the front panel.

(2) Remove the right and left side dust covers from the transmitter. Be sure that all tubes are in place (fig. 29).

(3) A patch cord is required to complete the connection when the transmitter is removed from the equipment cabinet. This cord is described in paragraph 43*b*. Connect the patch cord from jack J801 in the equipment cabinet to plug P401 on the rear of the transmitter.

(4) Connect the antenna to antenna jack J804 on the equipment cabinet.

(5) Determine the correct crystal frequency. The two preset operating frequencies of the transmitter may not differ by more than 1 mc. After selecting two operating frequencies that meet this requirement, choose the correct crystal frequency by using the following formula:

$$\text{Crystal frequency} = \frac{\text{Operating frequency}}{32}.$$

Example:

F_1=desired operating frequency=162 mc

F_2=alternate operating frequency 162±1 mc= 161 or 163 mc

F_c=crystal fundamental frequency

$$F_c = \frac{F1}{32} = \frac{162{,}000}{32}\text{ kc} = 5{,}062.5\text{ kc}$$

$$F_c = \frac{F2}{32} = \frac{161{,}000}{32}\text{ kc} = 5031.25\text{ kc}$$

To maintain accuracy of the operating frequency, carry division out to three places to the right of the decimal point. The above example shows the maximum allowable frequency difference between the two operating frequencies. Actually, more efficient transmitter operation is obtained when the two frequencies are closer together.

(6) Install the required crystals. To do this, first unplug the entire crystal oven assembly E401 (fig. 52). Remove the three screws that secure the cover of the crystal oven to the socket, unplug the heater and thermostat element from the socket, and insert the correct crystals into the socket base. Reassemble in the reverse order.

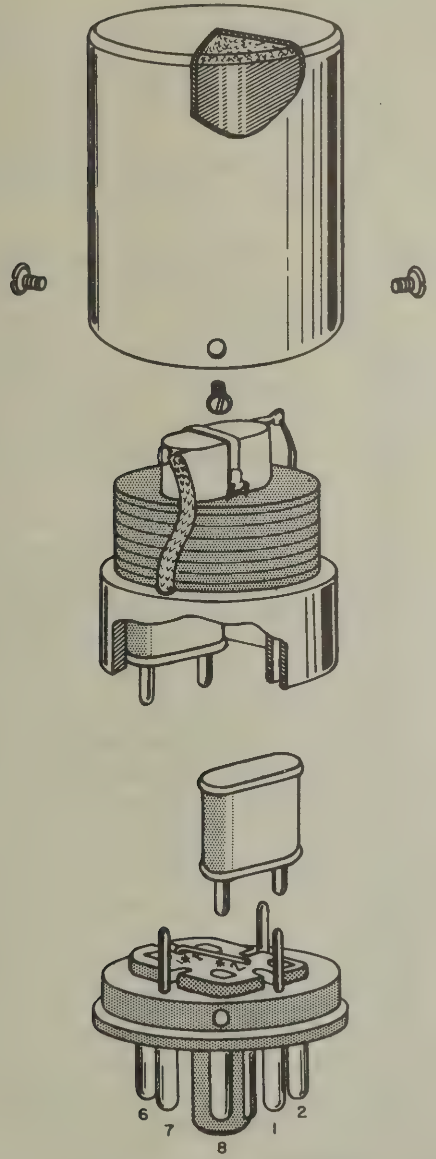


Figure 52. Radio transmitter T–278/U crystal oven, exploded view.

(7) Set the FREQ 1 and FREQ 2 capacitors (C403 and C404) on the transmitter chassis (fig. 53) to their mechanical midpoints.

(8) Turn the VOLUME-OFF switch on the control unit clockwise to apply power to the heating element of the crystal oven.

(9) Turn the FREQ 1–2 switch on the control unit either to the 1 or the 2 position to apply filament power to the desired oscillator.

(10) Allow at least 15 minutes warmup time.

b. Tuning Procedure. Refer to figures 23 and 53 for the location of test and alinement points on the transmitter.

Caution: Do not operate the transmitter for more than 3 minutes at a time during the alinement procedure. Allow 12 minutes for cooling after each 3 minutes of operation. Overheating of the transmitter power supply dynamotor may result from prolonged operation and insufficient cooling periods.

(1) Loosen the locknut on capacitor C448.

(2) Turn the capacitor to the extreme clockwise position (until the plates touch).

(3) Rotate the capacitor the number of counterclockwise turns indicated in the chart below for the desired operating frequency.

Operating frequency (mc)	Capacitor setting (counterclockwise turns)
152–158	1
158–162	1½
162–166	2
166–170	3
170–174	10

(4) Place the TEST-OFF switch on the transmitter in the TEST position.

(5) With the common lead of the vtvm grounded to the chassis and the selector switch set to read negative dc voltage, place the test probe in jack J401 on the transmitter Z401 for a maximum indication. Note this voltage, then detune

Z401 in a clockwise direction until the voltage at jack J401 is reduced to nine-tenths of the maximum noted above. Nominal voltage is —5 volts dc.

(6) Place test probe in jack J402 and adjust Z402 for maximum indication on the vtvm. Nominal voltage is —22 volts dc.

(7) Place test probe in jack J403 and adjust Z403 for maximum indication on the vtvm. Nominal voltage is —28 volts dc.

(8) Place test probe in jack J404 and adjust Z404 for maximum indication on the vtvm. Nominal voltage is —70 volts dc.

(9) Place the test probe in the DRIVER GRID test jack J405. Set the tuning slug of Z405 at approximately the same physical position as the other tuning slugs (Z401, Z402, Z403, Z404). Adjust the DRIVER GRID TUNE capacitor (C429) for maximum indication on the vtvm. Adjust Z405 for maximum indication on the vtvm. Some interaction between Z405 and C429 may be present; slight readjustment between the two may be necessary to obtain maximum indication on the vtvm. Nominal voltage at this stage is —55 volts dc.

(10) Place the test probe in FINAL GRID jack J406. Turn the FINAL GRID TUNE 1 capacitor C439 and the FINAL GRID TUNE 2 capacitor C437 so that the shaft slots are parallel and pointing at the 152 mark on the front panel. Remove the front panel by releasing the fastener on each side of the caution plate. Inspect the two capacitors. The plates should be slightly unmeshed to the right. If either or both of the capacitors is meshed on the left-hand side, rotate the capacitor shaft 180° so that the opposite end of the shaft slot is pointing at the 152 mark. Replace the front panel. Keeping the shaft slots parallel by alternately adjusting one and then the other in small clockwise movements, adjust FINAL GRID TUNE 1 and FINAL GRID TUNE 2 capacitors for maximum negative voltage. Adjust DRIVER PLATE TUNE capacitor C436 for maximum negative voltage. Nominal voltage at the completion of these adjustments is —57 volts dc.

(11) Place the TEST-OFF switch in the OFF position.

(12) Connect a vtvm across the PL CUR test jacks J409 and J410; observe proper polarity. Set voltmeter selector switch to read approximately 2.5 volts dc. The meter, so connected, will read 100 ma current per volt indicated.

Caution: If a voltmeter with a metal case is used to measure across the PL CUR jacks, be sure to insulate the case from the equipment chassis (ground). Both jacks are at a high positive potential. Do not touch the voltmeter while making measurements.

(13) Set the FINAL PLATE TUNE control at the physical center of its range.

(14) Place the TEST-OFF switch in the TEST position.

(15) Adjust the final plate capacitor C448 for minimum indication on the voltmeter.

(16) Place the TEST-OFF switch in the OFF position, and tighten the lock nut on capacitor C448.

(17) Place the TEST-OFF switch in the TEST position.

(18) Adjust the FINAL PLATE TUNE control for minimum indication on the voltmeter.

(19) Adjust the ANT TUNE capacitor for maximum voltmeter indication. If no voltage rise is noted, increase the COUPLING control by turning toward MAX and repeat adjustment of the ANT TUNE control.

(20) Turn the TUNE-OPR switch to OPR, and observe voltmeter reading. Adjust the COUPLING control toward MAX until a reading of 1-volt dc is observed on the meter.

(21) Readjust the FINAL PLATE TUNE control for minimum indication on the voltmeter.

(22) Readjust the ANT TUNE control for a maximum indication on voltmeter.

(23) Repeat (19) and (20) above as necessary to satisfy both conditions. Do not change either the FINAL PLATE TUNE or ANT TUNE controls after completing this adjustment.

(24) Increase the COUPLING control toward MAX until the voltmeter indicates

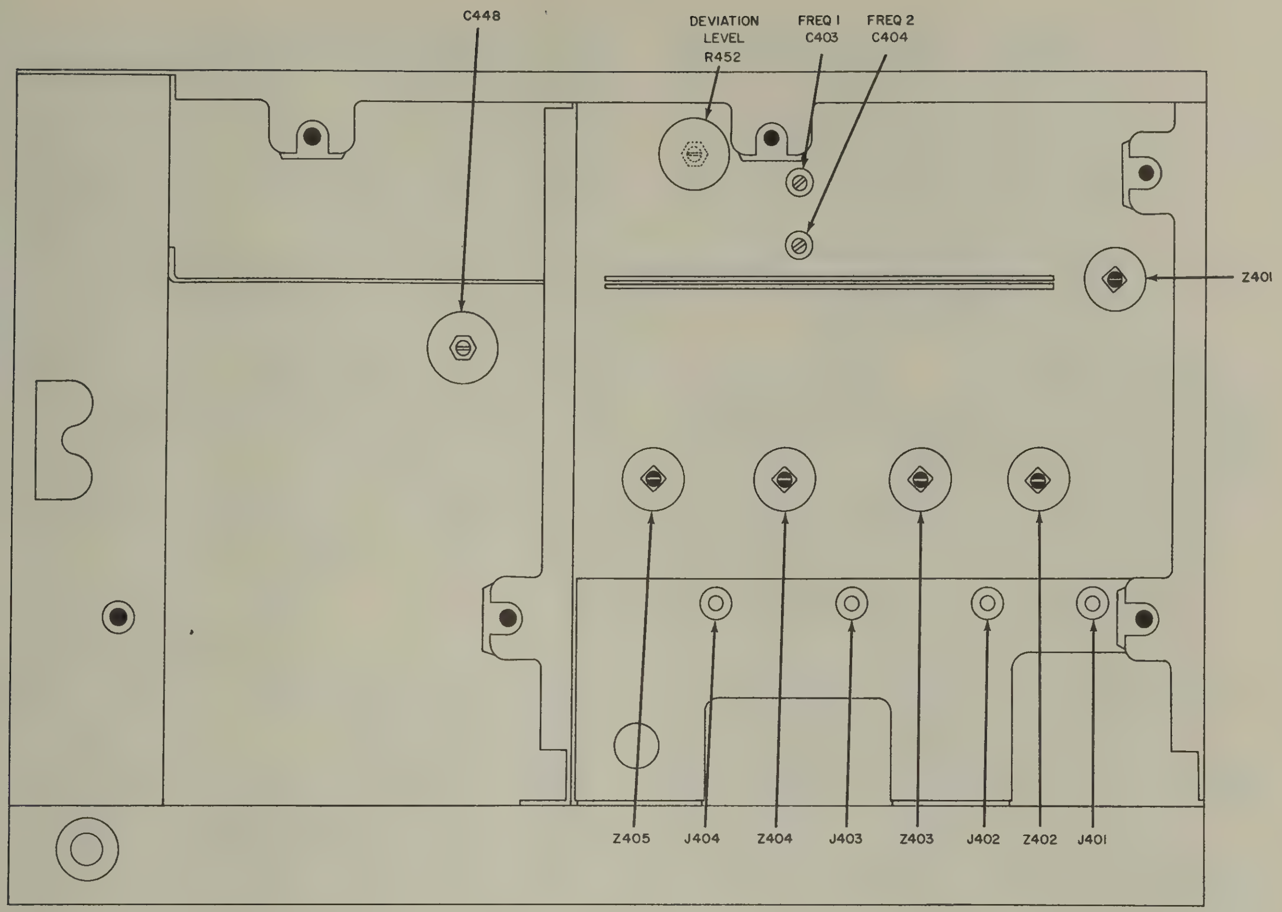


Figure 53. Right side of radio transmitter T–278/U showing alinement points.

1.5 volts dc which correspond to 150 ma.

(25) Place the TEST-OFF switch in the OFF position.

(26) Disconnect the voltmeter from PL CUR jacks and connect it across the BAL jacks J407 and J408.

(27) Place the TEST-OFF switch in the TEST position. If plate current of the power amplifier tubes is balanced, the voltmeter across the BAL jacks will read zero. If a deflection is noted at the BAL jacks, turn the FINAL GRID TUNE 1 control in a direction to reduce the deflection. Turn the FINAL GRID TUNE 2 control in the opposite direction to bring the grid circuit back to resonance. This is indicated by a maximum voltage reading on the vtvm when the test probe is connected to the FINAL GRID test jack and the common lead is connected to the chassis. Repeat these adjustments until balance is obtained.

(28) Place the TEST-OFF switch in the OFF position, and connect the voltmeter test leads to the PL CUR jacks.

(29) Place the TEST-OFF switch in the TEST position, and observe voltmeter indication. If necessary, readjust the COUPLING control to obtain a reading of 1.5 volts. This is proportional to 150 ma of plate current and represents the proper loading for Radio Transmitter T–278/U.

(30) Check the transmitter output frequencies by placing a wire connected to the output terminal of a frequency meter near the antenna circuit. (See instructions packed with frequency meter.)

(31) If frequency one or frequency two is incorrect, adjust capacitors C403 or C404 on the transmitter chassis (fig. 26) until

the correct frequency is indicated on the frequency meter. C403 and C404 vary the frequency of the frequency one and frequency two oscillators respectively. The transmitter is now completely tuned.

(32) Place the TEST-OFF switch in the OFF position.

(33) Disconnect meters, reassemble dust covers, and install the transmitter in the equipment cabinet.

86. Receiver Alinement

a. Preliminary Procedure. The following preliminary steps should be taken before proceeding with the alinement procedure:

(1) Release the receiver from the equipment cabinet by turning the hold-in lock counterclockwise; the receiver then may be pulled out of the equipment cabinet by using the handle located on the front panel.

(2) Remove the top cover and the plug-in assemblies marked LOCAL OSC 152–174 MC and RF AMPL 152–174 MC. Remove the plug-in assembly shields, and reinsert the plug-in units into the receiver.

(3) A patch cord is required to complete the connections from the receiver to the equipment cabinet.

(4) Determine the frequency to which the receiver is to be tuned. This information is needed when calculating the proper high-frequency oscillator crystal frequency (*b* below).

b. LOCAL OSC 152–174 MC Plug-in Unit Alinement Procedure. When a new operating frequency is to be used, high-frequency oscillator V31, tripler V32 and doubler V33 must be retuned. The procedure consists of a coarse adjustment to assure that the oscillator is operating near the desired frequency and a precise adjustment to tune the receiver exactly to the desired signal frequency. A vtvm is used during the procedure to give tuning indications. It is important to insert the right crystal in the crystal oven; otherwise, it will be impossible to tune the oscillator properly to the desired frequency. Crystal Y31 should be selected by the following formula:

$$\text{Center Crystal Frequency} = \frac{F_s - 7.8 \text{ mc}}{6}$$

In this formula, Crystal Frequency represents the frequency of the crystal that is to be found, and F_s represents the desired signal frequency in *mc*. After the correct crystal has been selected, remove crystal oven E31 (fig. 31) and insert the new crystal. Use the same procedure indicated for disassembly of the transmitter crystal oven (par. 85*a*(6)). Set the vtvm to a suitable range to read negative dc voltage, and connect the common lead to the GND test point on the front panel of the receiver. Connect the positive test probe as indicated in the vtvm connection column of the following chart. Use the procedure in the chart to aline the unit. Refer to figures 55, 56, and 57 to locate the adjustment and test points. Refer to figure 54 for the location of the plug-in unit.

Vtvm connection	Adjustment	Indication
None	Z31 unscrewed almost all the way counterclockwise.[a]	None.
Terminal on TB31 to which R40 connects (first term. from front of local osc chassis).	Z31	Maximum negative voltage.
Terminal on TB31 to which R34 connects (fourth term. from front of local osc chassis).	Z32 and Z33	Maximum negative voltage.
LO test point (front panel of receiver).	Z34	Maximum negative voltage.

[a] Z31 will have to be slightly readjusted later in the procedure.

c. RF AMPL 152–174 MC Plug-in Unit Alinement Procedure.

(1) *Presetting tuning cores.* Before alining the RF AMPL 152–174 MC plug-in unit, preset the tuning core slugs to allow a signal to pass through the detuned stages. This is accomplished by adjusting the tuning cores to their approximately correct positions. The chart below lists various receiver frequencies and the corresponding number of turns that the tuning cores must be adjusted for each frequency. Columns 2 and 3 list the number of turns that the core slugs must be turned *in* from the extreme counterclockwise positions. Before using these two columns turn the five tuning cores (Z1, Z2, Z3, Z4, and Z5) to their extreme counterclockwise positions. In this posi-

tion the top of the screws will extend approximately thirteen-sixteenths of an inch above the chassis. If the equipment is received directly from the factory, it is not necessary to turn all adjustments to the extreme counterclockwise position before presetting. The receivers are tuned for 165.075 mc at the factory and column 4 lists the direction and number of turns that the tuning cores must be changed from the factory-set position. A spot of paint or some other type of mark on the alinement tool will make it easier to count the number of turns. Tuning slug Z6 is preset to 7.8 mc at the factory and must not be disturbed until all other coils have been alined.

1	2	3	4
Receiver frequency (mc)	Number of clockwise turns of tuning core		Number of turns of tuning cores from factory-set position (Z1, Z2, Z3, Z4, and Z5)
	Z1, Z2, Z4	Z3, Z5	
152	7	9	10 out (counterclockwise).
153	8	10	9 out (counterclockwise).
154	9	11	8 out (counterclockwise).
155	10	12	7 out (counterclockwise).
156	10¾	12¾	6¼ out (counterclockwise).
157	11½	13½	5½ out (counterclockwise).
158	12¼	14¼	4¾ out (counterclockwise).
159	13	15	4 out (counterclockwise).
160	13¾	15¾	3¼ out (counterclockwise).
161	14½	16½	2½ out (counterclockwise).
162	15¼	17¼	1¾ out (counterclockwise).
163	15¾	17¾	1¼ out (counterclockwise).
164	16½	18½	½ out (counterclockwise).
165	17	19	0.
166	17¾	19¾	¾ in (clockwise).
167	18½	20½	1½ in (clockwise).
168	19¼	21¼	2¼ in (clockwise).
169	20¼	22¼	3¼ in (clockwise).
170	21	23	4 in (clockwise).
171	21¾	23¾	4¾ in (clockwise).
172	22½	24½	5½ in (clockwise).
173	23¼	25¼	6¼ in (clockwise).
174	24	26	7 in (clockwise).

(2) *Final Adjustment.* After the RF AMPL 152–174 MC plug-in unit has been roughly preset, it must be accurately alined. To perform this accurate alinement, use the following procedure:

(*a*) Connect a signal generator between plug P1 and chassis ground. Set the signal generator output to 20 microvolts. This should be sufficient to allow a signal to pass through the preset stages.

(*b*) Connect a vtvm between the 2ND IF and GND test points located on the front panel of the receiver.

(*c*) Adjust Z1, Z2, Z3, Z4, and Z5 for a maximum negative output as indicated on the meter. Repeat this procedure at least 3 times. If the vtvm reads off-scale, reduce the signal generator output.

d. Adjusting Receiver to Transmitter Frequency. As explained in paragraph 83*a*, it is usually not possible to aline the receiver exactly to the distant transmitter frequency by the use of a signal generator. A slight adjustment of the high-frequency crystal oscillator will be necessary to aline the receiver with a signal from the distant transmitter. The procedure is as follows:

1. Place the receiver in operation as described in paragraph 35. Be sure that the transmitter is operating on the desired signal frequency. The radio set must be connected to an antenna for this adjustment.
2. Connect a vtvm to the receiver front panel test points marked DISCR and GND. Set the vtvm to a positive low-voltage scale.
3. Readjust oscillator warping coil Z31 for a +1-volt reading on the vtvm.
4. The receiver now is adjusted completely to the operating frequency and can be replaced in the equipment cabinet.

87. System Alinement Procedure

Caution: Failure to follow these instructions may result in poor system performance.

a. General. To obtain optimum system performance when all transmitters and receivers are operated on the same frequency channel, it is necessary to perform the following procedure. The purpose of this procedure is to have all receivers and transmitters in the system alined to the exact operating frequency. This is accomplished by using one of the receivers as a frequency standard when adjusting the frequency of each transmitter. All of the other receivers in the system are then alined by using one of the transmitters as a frequency standard. However, before attempting the system alinement procedure, it is necessary to have each individual receiver and transmitter

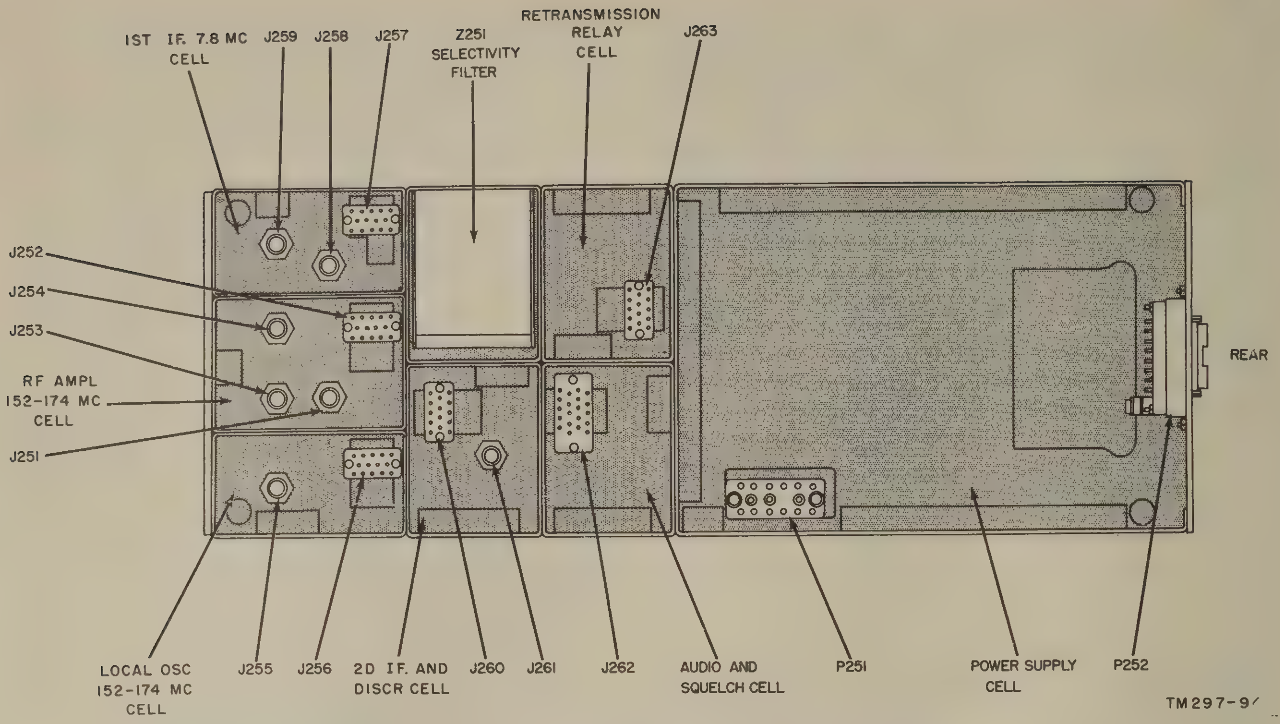


Figure 54. Radio receiver R–394/U, compartment location.

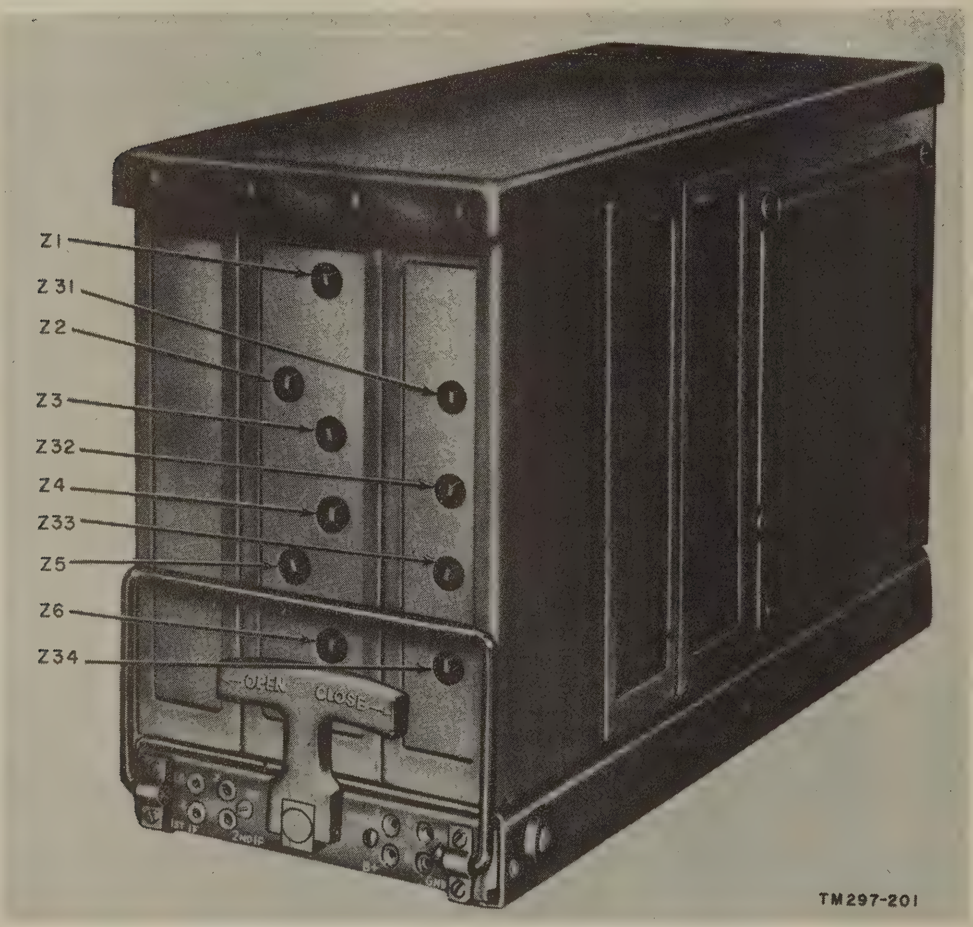


Figure 55. Radio receiver R–394/U, front panel alinement.

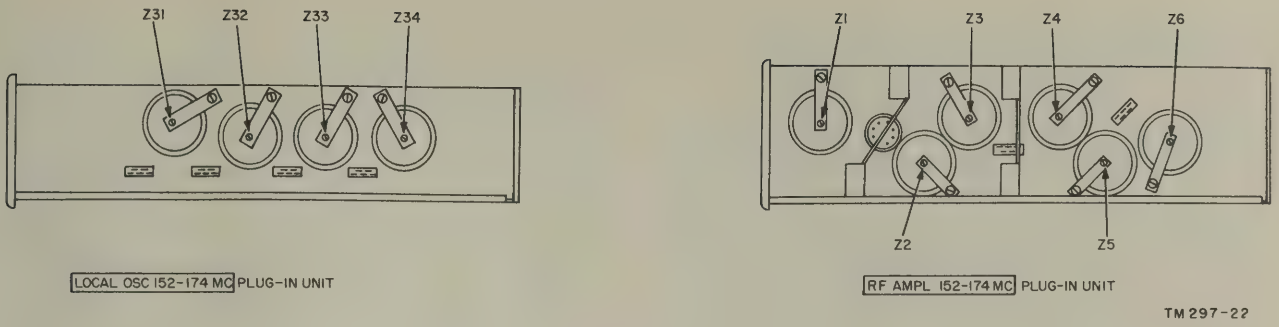

Z31
Z32
Z33
Z34
LOCAL OSC 152–174 MC PLUG-IN UNIT
Z1
Z3
Z4
Z6
Z2
Z5
RF AMPL 152–174 MC PLUG-IN UNIT
TM 297-22

Figure 56. Radio receiver R–394/U rf amplifier and local oscillator plug-in units, alinement points

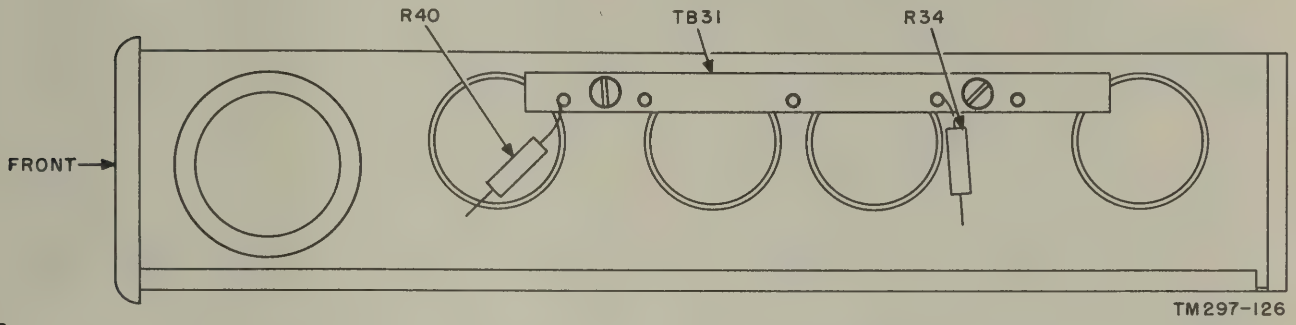


Figure 57. Local oscillator plug-in unit, bottom view showing alinement test points.

alined to the approximate operating frequency.

b. Checking Receiver Alinement. The following procedure should be applied to all receivers in the system. Remove the shield from the LOCAL OSC 152–174 MC plug-in unit. With a vtvm set to a suitable range, make the measurements listed in the following chart. These measurements should be made with no signal being received. The voltages listed in the nominal reading column are those of a normally alined receiver. If these voltages are not obtained, perform the adjustments recommended in the correction column. Refer to figure 55 for adjustment locations. Turn the VOLUME-OFF switch on the control unit clockwise to apply power to the receiver. Leave the switch in this position for all subsequent steps of the procedure. If the readings in the following chart cannot be obtained, complete receiver alinement will be necessary. Refer to paragraph 86 and the instruction book on the receiver.

Test point		Nominal reading (volts)	Correction
From	To		
FIL jack	GND jack	1.2 to 1.5	Refer to the instruction book for Radio Receiver R–394/U for troubleshooting information.
B+ jack	GND jack	140 to 180	Refer to the instruction book for Radio Receiver R–394/U for troubleshooting information.
Test point 1 inside oscillator plug-in unit (top terminal of right hand terminal board TB31).	GND jack	−4 to −8	Adjust Z31 for maximum negative voltage.
L. O. jack	GND jack	−1.5 to −5	Adjust Z32, Z33, and Z34 for maximum negative voltage.
2ND IF jack	GND jack	−.1 to −1.5	Adjust Z1, Z2, Z3, Z4, Z5, and Z6 for maximum negative voltage.
DISCR jack	GND jack	−1 to +2[a]	Refer to the instruction book for Radio Receiver R–394/U for troubleshooting information.

---

[a] Record this reading.

c. Checking Transmitter Alinement. The following procedure should be applied to all transmitters in the system. With a vtvm set to a suitable range, make the measurements listed in the following chart. The voltages listed in the nominal reading column are those of a normally alined transmitter. If these voltages are not obtained, perform the adjustments recommended in the correction column. Refer to figure 23 for test point and adjustment locations. Place the TUNE-OPR switch in the TUNE position. Place the TEST-OFF switch in the TEST position. If the readings in the following chart cannot be obtained, complete transmitter alinement will be necessary. Refer to paragraph 85.

Test point		Nominal reading (volts)		Correction
From	To	TUNE position	OPR position	
FINAL GRID jack.	Ground	−25 to −40	−40 to −80	Adjust FINAL GRID TUNE 1 for maximum negative voltage. Adjust FINAL GRID TUNE 2 for maximum negative voltage. Adjust DRIVER PLATE TUNE for maximum negative voltage. *Note.* The FINAL GRID TUNE capacitors should be adjusted to approximately equal capacity by keeping the shaft slots parallel.

d. Checking Transmitter Frequency. The discriminator balances of the receivers are used as an indication to check the frequency of the transmitter that will be used to start the system alinement procedure. Select one of the transmitters, and see whether its frequency is close to that of the receivers by performing the following procedure.

(1) Disable the receiver squelch circuits by tuning the SQUELCH controls fully clockwise. A rushing noise should be heard.

(2) Allow 5 minutes warmup time for the receiver and transmitter crystal ovens.

(3) Place the transmitter TUNE-OPR switch in the TUNE position.

(4) Turn the TEST-OFF switch to the TEST position and make and record the following measurements for each receiver. The receivers should be quieted when the transmitter is turned on. If correct readings are obtained, proceed with *f* below. If all receivers show discriminator readings too far off (negative voltage greater than −3 or positive voltage greater than +4), another transmitter should be tried. If a transmitter cannot be found that gives proper discriminator readings, it will be necessary to adjust the frequency of one transmitter as follows.

Test point		Nominal reading (volts)
From	To	
2ND IF jack	GND jack	−4 to −15.
DISCR jack	GND jack	−3 to +4.

e. Preliminary Adjustment of Transmitter Frequency. Remove the transmitter from the cabinet by turning the handle counterclockwise and by pulling the transmitter forward out of the cabinet. Connect the transmitter to the cabinet by means of a patch cord (Special Purpose Electrical Cable Assembly CX–2371/U). If no patch cord is available, refer to *h* below.

(1) Select the receiver with a discriminator reading closest to the average of all readings obtained in the last step of *b* above.

(2) Allow at least 5 minutes warmup time for the receiver and transmitter crystal ovens.

(3) Connect a vtvm between the DISCR and GND test points on the receiver.

(4) Turn the TEST-OFF switch on the transmitter to the TEST position.

(5) Adjust C403 or C404, figure 53, depending on the oscillator being used, until the discriminator reading is between 0 and +1 volt.

(6) Turn the TEST-OFF switch to the OFF position. The transmitter may now be used to perform the procedure of *d* above.

f. Final Adjustment of Transmitter Frequency.

(1) Select the receiver with a discriminator reading nearest the average of all readings obtained in *d*(4) above.

(2) Allow at least 5 minutes warmup time for the transmitter and receiver crystal ovens.

(3) Turn the TEST-OFF switch on the transmitter to the TEST position.

(4) Adjust C403 or C404, figure 53, depending on the oscillator being used, until the reading at the DISCR test point is equal to the reading obtained in *b* above for that receiver (between −1 and +2 volts).

(5) Turn the TEST-OFF switch to the OFF position.

(6) Repeat (2) through (5) above for each transmitter.

g. Receiver Frequency Adjustment. To aline the receivers other than the one in *f*(1) above, which is already alined to the exact transmitter signal, adjust the first high frequency oscillator in each of the receivers as follows:

(1) Use the transmitter that was selected for the procedure of *d* above.

(2) Connect a vtvm between the DISCR and GND test points on the receiver being alined.

(3) Allow at least 5 minutes warmup time before proceeding with the following step.

(4) Turn the TEST-OFF switch on the transmitter to the TEST position.

(5) Adjust Z31 (fig. 55) until the reading at the DISCR test point is between −1 and +2 volts.

(6) Check the voltage at the L. O. test point. The reading should be between −1.3 and −5 volts. If this reading cannot be obtained, refer to the receiver instruction book for troubleshooting information.

(7) Repeat (1) through (6) above for each receiver to be used in the system and all receivers will be alined to the same frequency.

h. Transmitter Alinement without Patch Cord. If no patch cord (Special Purpose Electrical Cable Assembly CX–2371/U) is available and it is necessary to make the transmitter frequency adjustments, proceed as follows:

(1) Select the receiver with a discriminator reading nearest the average of all readings obtained in *d*(4) above.

(2) Allow at least 5 minutes warmup time for the crystal ovens in the receiver and transmitter.

(3) Connect a vtvm between the DISCR and GND test points on the receiver.

(4) Turn the TEST-OFF switch on the transmitter to the TEST position.

(5) Record the reading obtained at the DISCR test point.

(6) Turn the TEST-OFF switch to the OFF position.

(7) Remove the transmitter from the case and remove both dust covers.

(8) If the DISCR reading is too far on the positive (+) side, adjust C403 or C404, depending on the oscillator used, for less capacitance (plates further open). If the reading is too far on the negative (−) side, adjust C403 or C404 for more capacitance (plates further closed).

Note. Do not change the capacitor setting more than 15° at a time.

(9) Put the transmitter back in the case and repeat (3) through (8) above until the reading is within 0.5 volt of the desired value. The desired value is equal to the receiver discriminator voltage with the transmitter off, as in the last measurement of *b* above.

(10) Replace transmitter dust covers. The transmitter may now be considered on frequency for optimum system performance.

i. Alinement without a Vtvm. If a vtvm is not available, it is possible to use a 0 to 50 microammeter for transmitter and receiver alinement. On the microampere scale, the meter will read 1 microampere per volt at the following points: test point 1, L. O., 2ND IF, and DISCR in the receiver and FINAL GRID jack in the transmitter.

Caution: Do not use this meter at the FIL and B+ test points of the receiver; use a suitable voltmeter if available.

j. Use of Frequency Meter TS–174B/U. If a frequency meter such as Frequency Meter TS–174B/U is available, the operating frequency can be checked as follows:

(1) Carefully adjust the frequency meter to the operating frequency of the system.

(2) Allow a receiver to pick up the signal radiated by the frequency meter and

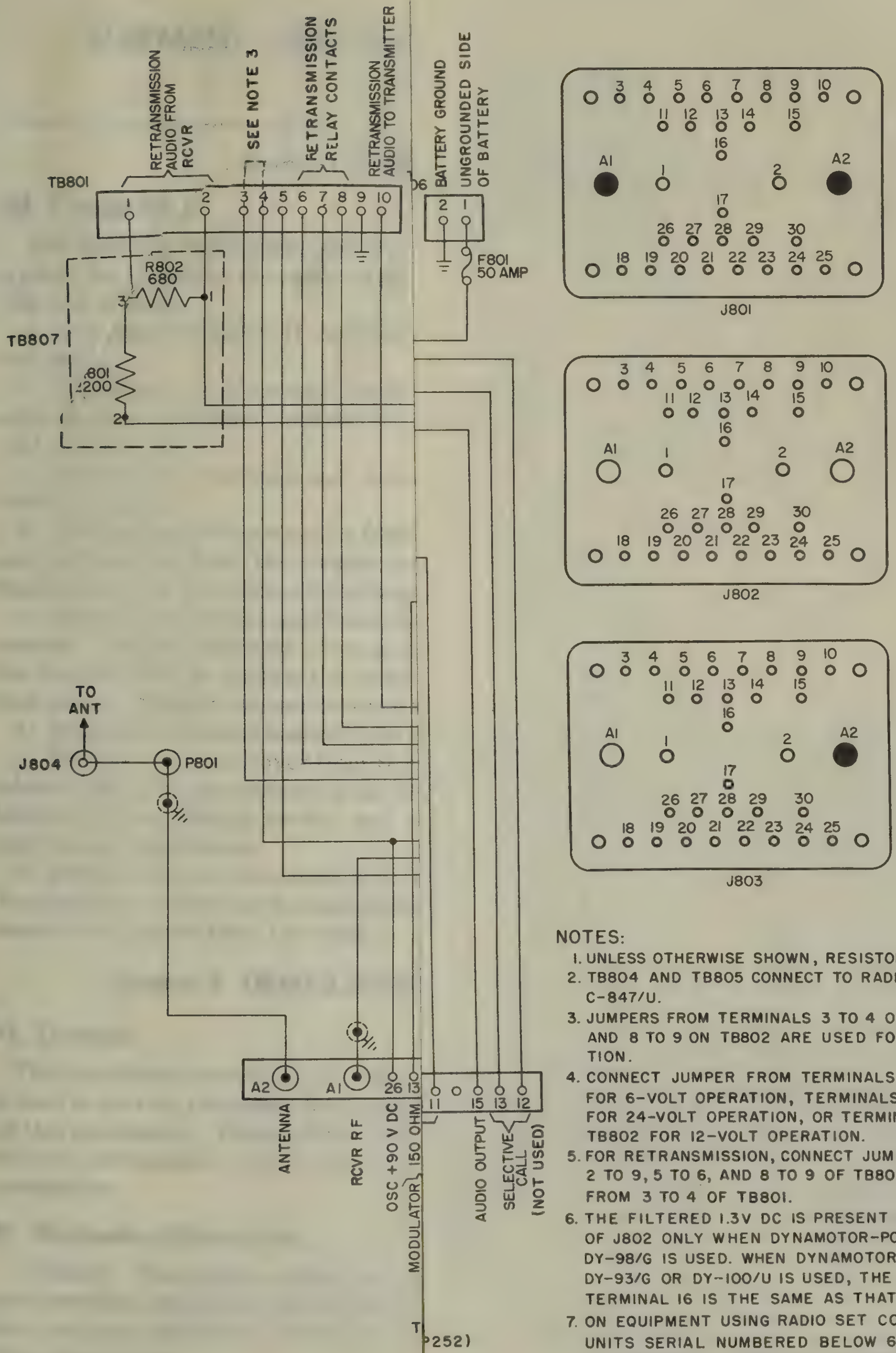
record the reading obtained at the DISCR test point.

(3) Turn off the frequency meter.

(4) Turn the TEST-OFF switch on the transmitter to the TEST position.

(5) Record the reading obtained at the receiver DISCR test point.

(6) Comparison of the two readings will give an additional check of the transmitter frequency. The discriminator voltage will change approximately 0.5 to 0.7 volt per kilocycle. An increase in the positive direction indicates that the transmitter frequency is low and an increase in the negative direction indicates that the transmitter frequency is high.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.
2. TB804 AND TB805 CONNECT TO RADIO SET CONTROL C-847/U.
3. JUMPERS FROM TERMINALS 3 TO 4 ON TB801, 5 TO 6 AND 8 TO 9 ON TB802 ARE USED FOR NORMAL OPERATION.
4. CONNECT JUMPER FROM TERMINALS 1 TO 2 OF TB803 FOR 6-VOLT OPERATION, TERMINALS 2 TO 3 OF TB803 FOR 24-VOLT OPERATION, OR TERMINALS 3 TO 4 OF TB802 FOR 12-VOLT OPERATION.
5. FOR RETRANSMISSION, CONNECT JUMPERS FROM 1 TO 10, 2 TO 9, 5 TO 6, AND 8 TO 9 OF TB801. REMOVE JUMPER FROM 3 TO 4 OF TB801.
6. THE FILTERED 1.3V DC IS PRESENT AT TERMINAL 16 OF J802 ONLY WHEN DYNAMOTOR-POWER SUPPLY DY-98/G IS USED. WHEN DYNAMOTOR-POWER SUPPLY DY-93/G OR DY-100/U IS USED, THE VOLTAGE AT TERMINAL 16 IS THE SAME AS THAT AT TERMINAL 28.
7. ON EQUIPMENT USING RADIO SET CONTROL C-847/U UNITS SERIAL NUMBERED BELOW 601, THE 2V MICROPHONE VOLTAGE MAY BE PRESENT AT PIN 15 OF J801 AND TERMINAL 20 OF TB805.

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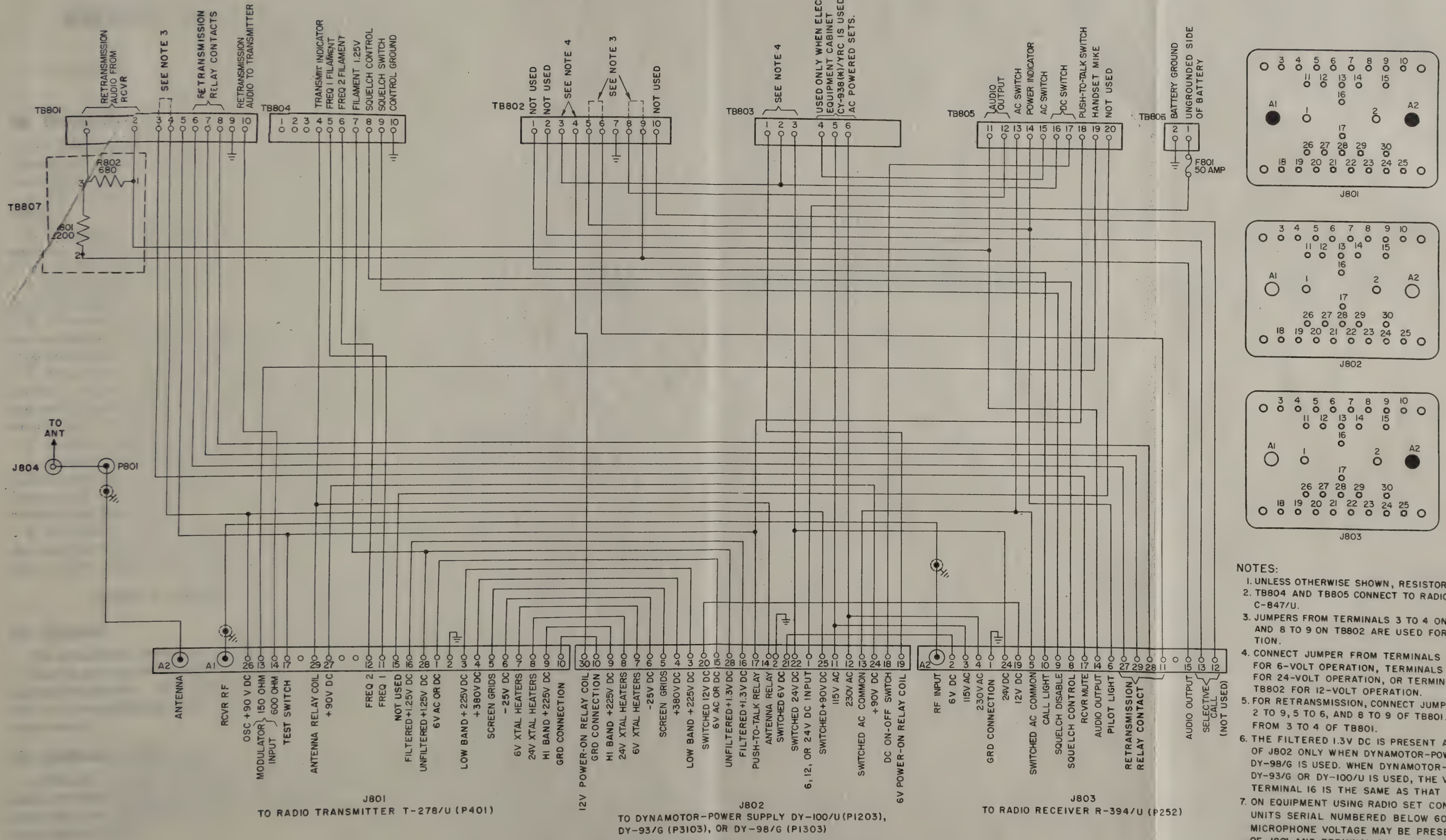
record the reading obtained at the DISCR test point.

(3) Turn off the frequency meter.

(4) Turn the TEST-OFF switch on the transmitter to the TEST position.

(5) Record the reading obtained at the receiver DISCR test point.

(6) Comparison of the two readings will give an additional check of the transmitter frequency. The discriminator voltage will change approximately 0.5 to 0.7 volt per kilocycle. An increase in the positive direction indicates that the transmitter frequency is low and an increase in the negative direction indicates that the transmitter frequency is high.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.
2. TB804 AND TB805 CONNECT TO RADIO SET CONTROL C-847/U.
3. JUMPERS FROM TERMINALS 3 TO 4 ON TB801, 5 TO 6 AND 8 TO 9 ON TB802 ARE USED FOR NORMAL OPERATION.
4. CONNECT JUMPER FROM TERMINALS 1 TO 2 OF TB803 FOR 6-VOLT OPERATION, TERMINALS 2 TO 3 OF TB803 FOR 24-VOLT OPERATION, OR TERMINALS 3 TO 4 OF TB802 FOR 12-VOLT OPERATION.
5. FOR RETRANSMISSION, CONNECT JUMPERS FROM 1 TO 10, 2 TO 9, 5 TO 6, AND 8 TO 9 OF TB801. REMOVE JUMPER FROM 3 TO 4 OF TB801.
6. THE FILTERED 1.3V DC IS PRESENT AT TERMINAL 16 OF J802 ONLY WHEN DYNAMOTOR-POWER SUPPLY DY-98/G IS USED. WHEN DYNAMOTOR-POWER SUPPLY DY-93/G OR DY-100/U IS USED, THE VOLTAGE AT TERMINAL 16 IS THE SAME AS THAT AT TERMINAL 28.
7. ON EQUIPMENT USING RADIO SET CONTROL C-847/U UNITS SERIAL NUMBERED BELOW 601, THE 2V MICROPHONE VOLTAGE MAY BE PRESENT AT PIN 15 OF J801 AND TERMINAL 20 OF TB805.

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Figure 58. Electrical equipment cabinet CY-938(*)/VRC, schematic diagram.

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CHAPTER 6
SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

88. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage.

a. Disconnect Handset H–33/PT from the control unit.

b. Disconnect the coaxial cable from the antenna and equipment cabinet. Coil up this cable for packing.

c. Remove the antenna and antenna mount from the vehicle.

d. Disconnect the battery cable from the battery and unfasten it from the vehicle so that it is attached only at the equipment cabinet.

e. Remove the control unit from the mounting bracket. Remove the back cover and disconnect the control cable by pulling the cable leads from their jacks. Replace the rear cover on the control.

f. Remove the control bracket from the vehicle.

g. Remove the front cover from the equipment cabinet and take the receiver from the cabinet. Disconnect the battery cables, and replace the receiver and front cover.

h. Remove the four mounting bolts that secure the equipment cabinet to the equipment rack, and remove the cabinet from the vehicle.

i. Remove the rear cover from the equipmen cabinet, and disconnect the leads of the contro cable. Pull the control cable away from the cabinet. Replace the rear cover.

j. Unbolt the equipment rack from the vehicle.

89. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on how much original packing material was saved or what new material is available. It also depends on the conditions under which the radio set is to be shipped or stored. Repack the equipment by reversing the instructions given in paragraph 25, if possible. When the original cases and cartons are not available, try to duplicate the original packing.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the chest. Do not use old dehydrating agents since they will offer no protection against damage to the equipment from moisture. Protect the packaging with a waterproof sealing compound or tape. Always provide at least 3 inches of excelsior padding or similar material between the inner cartons and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

90. General

The demolition procedures in paragraph 91 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

91. Methods of Destruction

a. Smash. Smash the crystals, controls, tubes, coils, switches, capacitors, transformers, and handsets; use axes, handaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut cords, handsets, and wiring; use axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

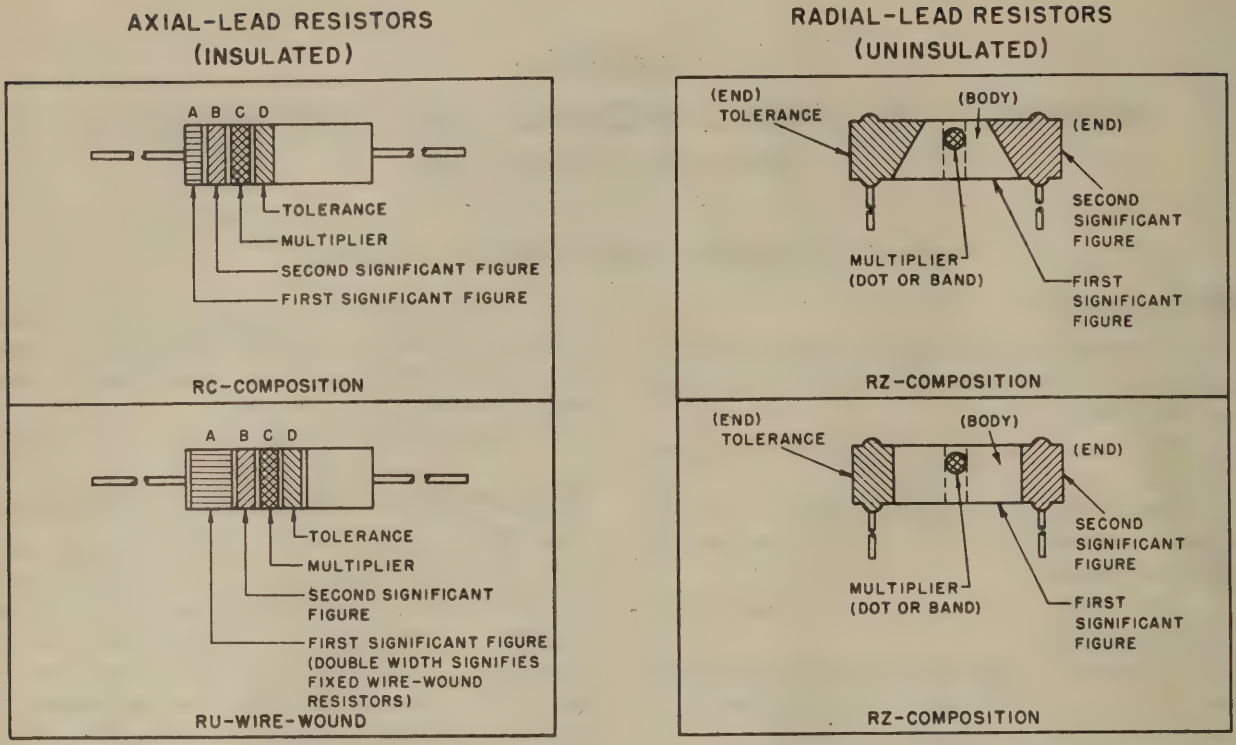
d. Bend. Bend panels, cabinets, and chassis.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy. Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

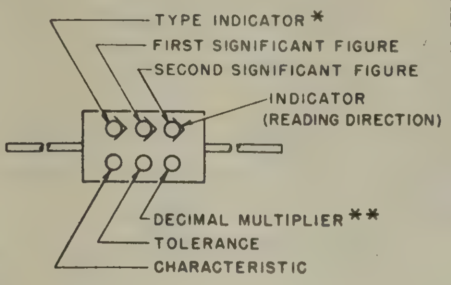
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

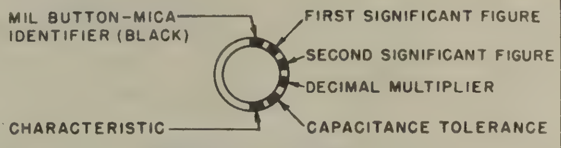
Figure 59. Resistor color codes

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)

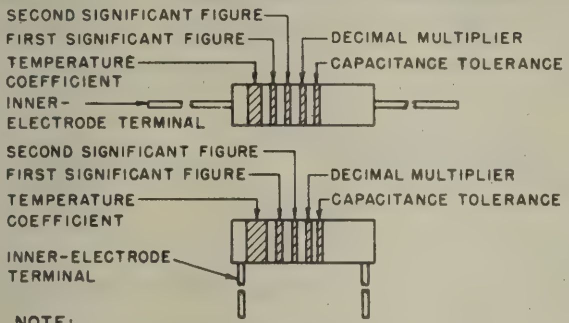


* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)

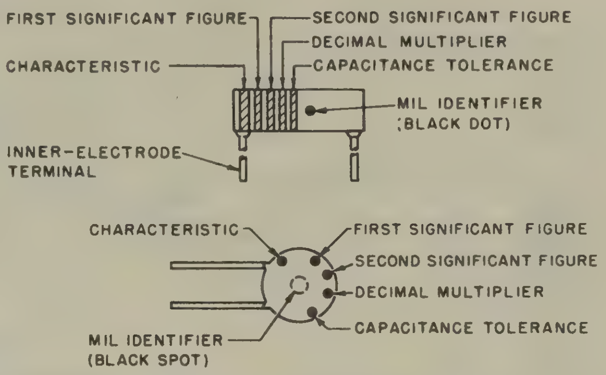


BUTTON-MICA (CB)



NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



NOTES:

1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, -20%.

CERAMIC-GENERAL PURPOSE (CK)

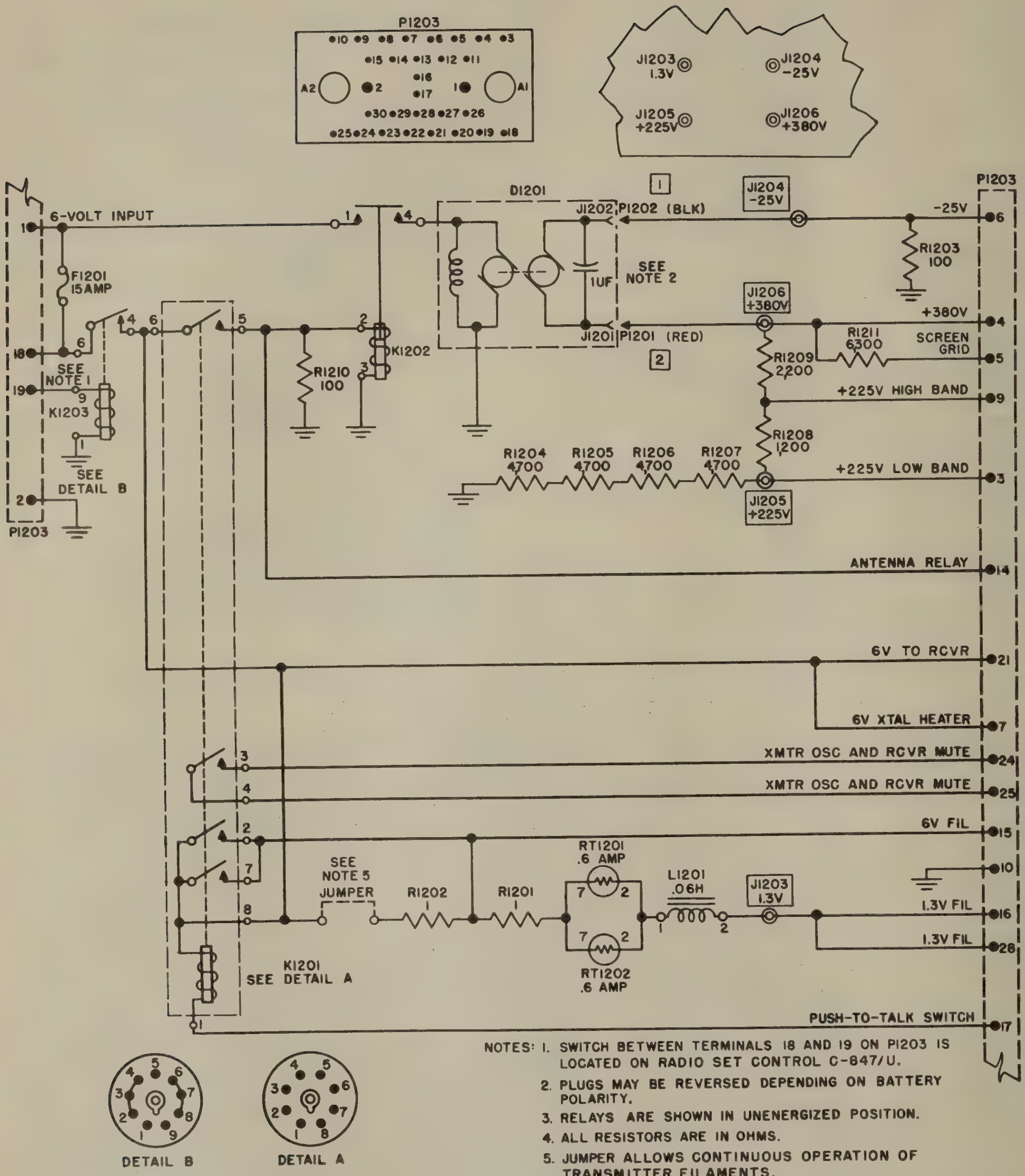
CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		CC
											OVER 10UUF	10UUF OR LESS	
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

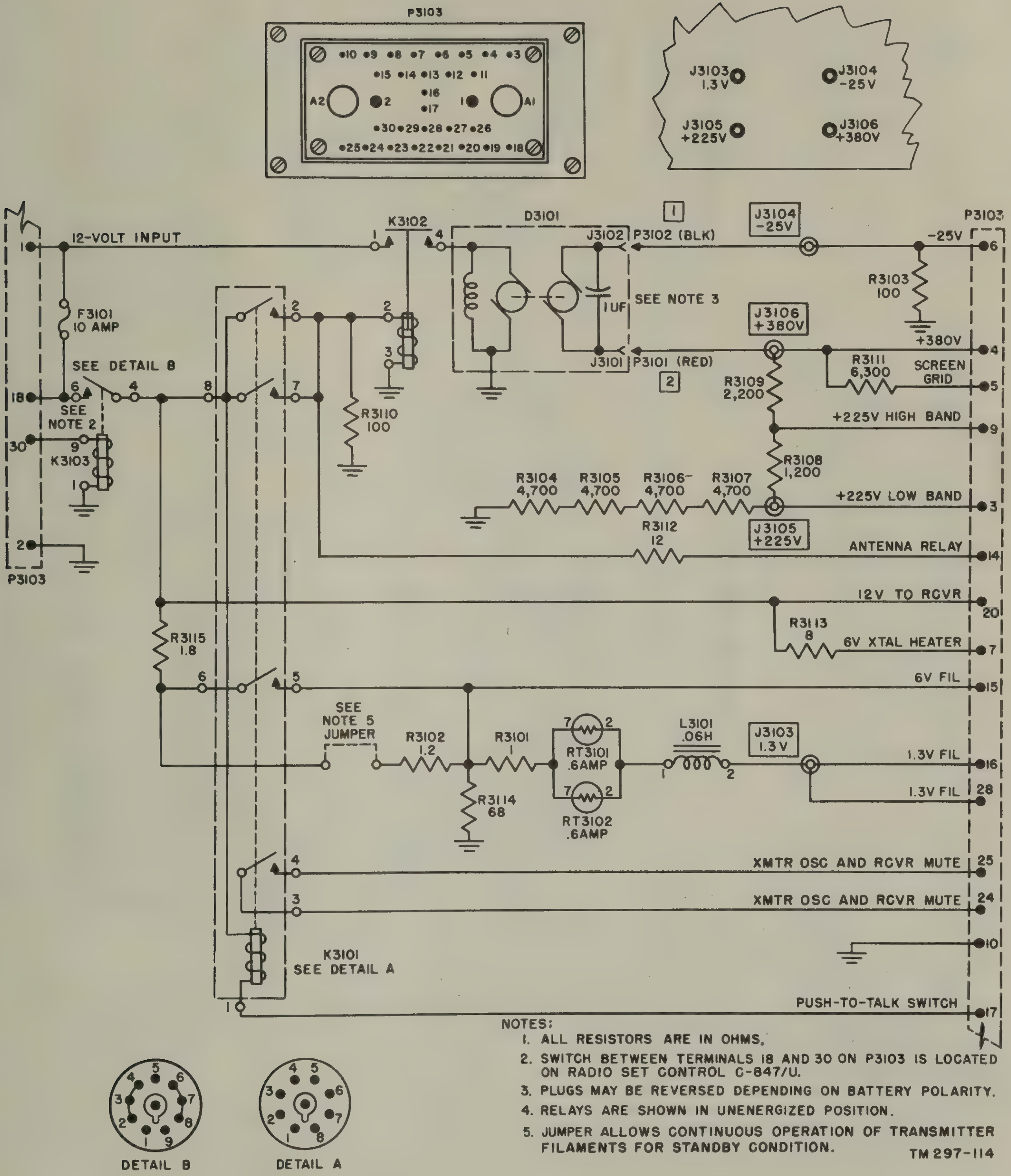
STD-C1

Figure 60. Capacitor color codes



NOTES:
1. SWITCH BETWEEN TERMINALS 18 AND 19 ON P1203 IS LOCATED ON RADIO SET CONTROL C-847/U.
2. PLUGS MAY BE REVERSED DEPENDING ON BATTERY POLARITY.
3. RELAYS ARE SHOWN IN UNENERGIZED POSITION.
4. ALL RESISTORS ARE IN OHMS.
5. JUMPER ALLOWS CONTINUOUS OPERATION OF TRANSMITTER FILAMENTS.

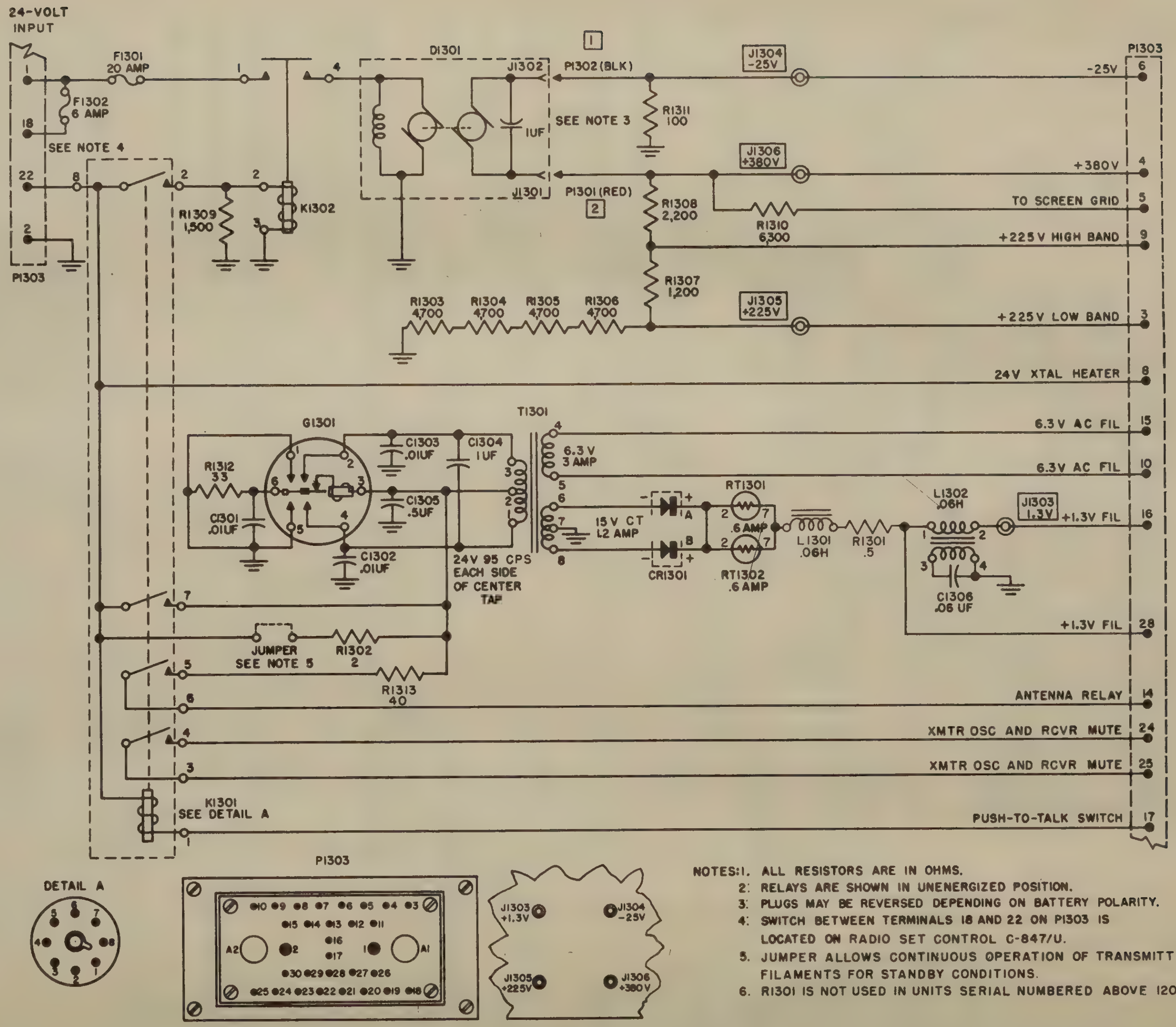
Figure 61. Dynamotor-power supply DY-100/U, schematic diagram.



NOTES:

1. ALL RESISTORS ARE IN OHMS.
2. SWITCH BETWEEN TERMINALS 18 AND 30 ON P3103 IS LOCATED ON RADIO SET CONTROL C-847/U.
3. PLUGS MAY BE REVERSED DEPENDING ON BATTERY POLARITY.
4. RELAYS ARE SHOWN IN UNENERGIZED POSITION.
5. JUMPER ALLOWS CONTINUOUS OPERATION OF TRANSMITTER FILAMENTS FOR STANDBY CONDITION.

Figure 62. Dynamotor-power supply DY–93/G, schematic diagram.



NOTES: 1. ALL RESISTORS ARE IN OHMS.
2. RELAYS ARE SHOWN IN UNENERGIZED POSITION.
3. PLUGS MAY BE REVERSED DEPENDING ON BATTERY POLARITY.
4. SWITCH BETWEEN TERMINALS 18 AND 22 ON P1303 IS LOCATED ON RADIO SET CONTROL C-847/U.
5. JUMPER ALLOWS CONTINUOUS OPERATION OF TRANSMITTER FILAMENTS FOR STANDBY CONDITIONS.
6. R1301 IS NOT USED IN UNITS SERIAL NUMBERED ABOVE 1200.

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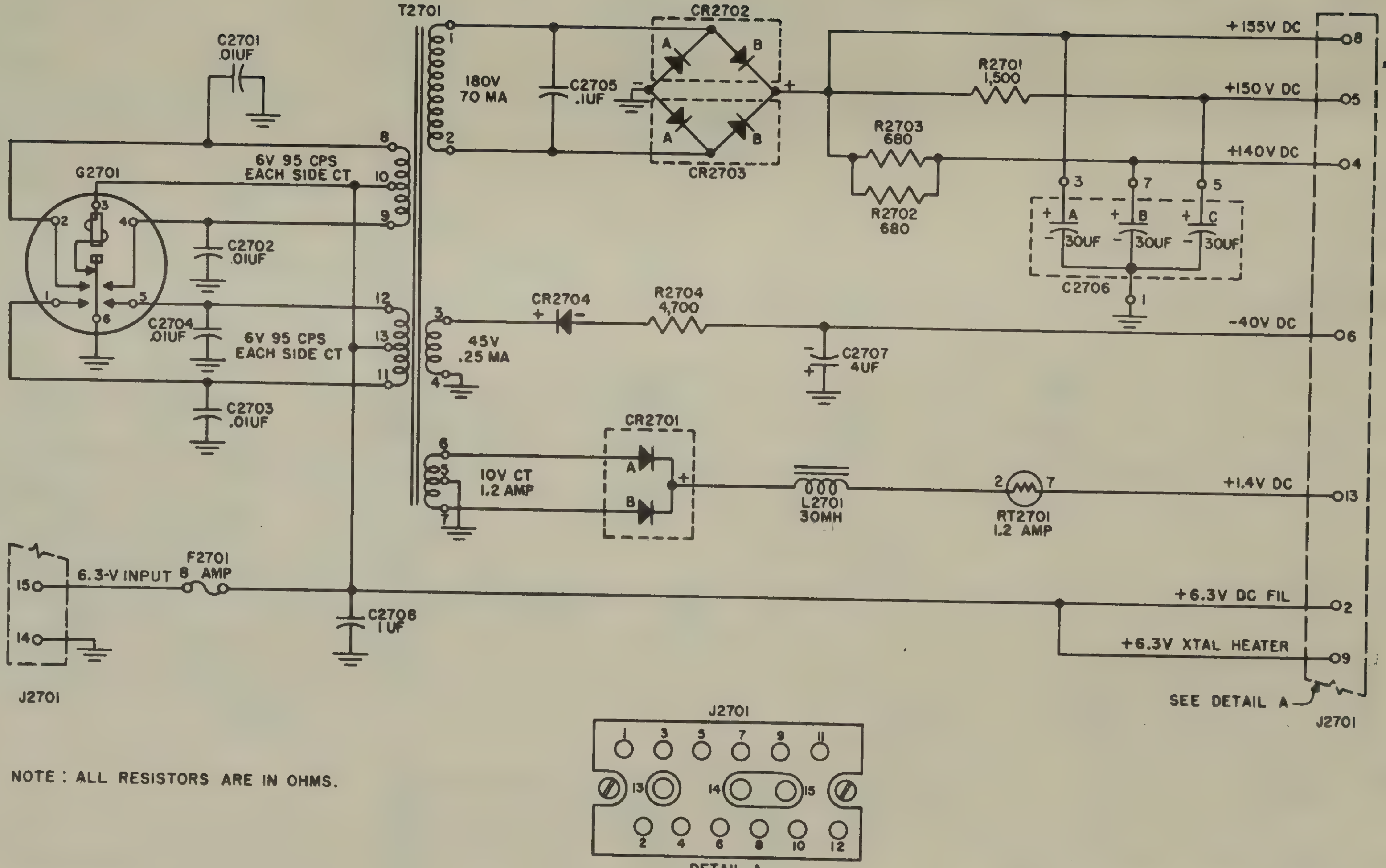
Figure 63. Dynamotor-power supply DY–98/G, schematic diagram



NOTE : ALL RESISTORS ARE IN OHMS.

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Figure 64. Power supply PP-869/U, schematic diagram

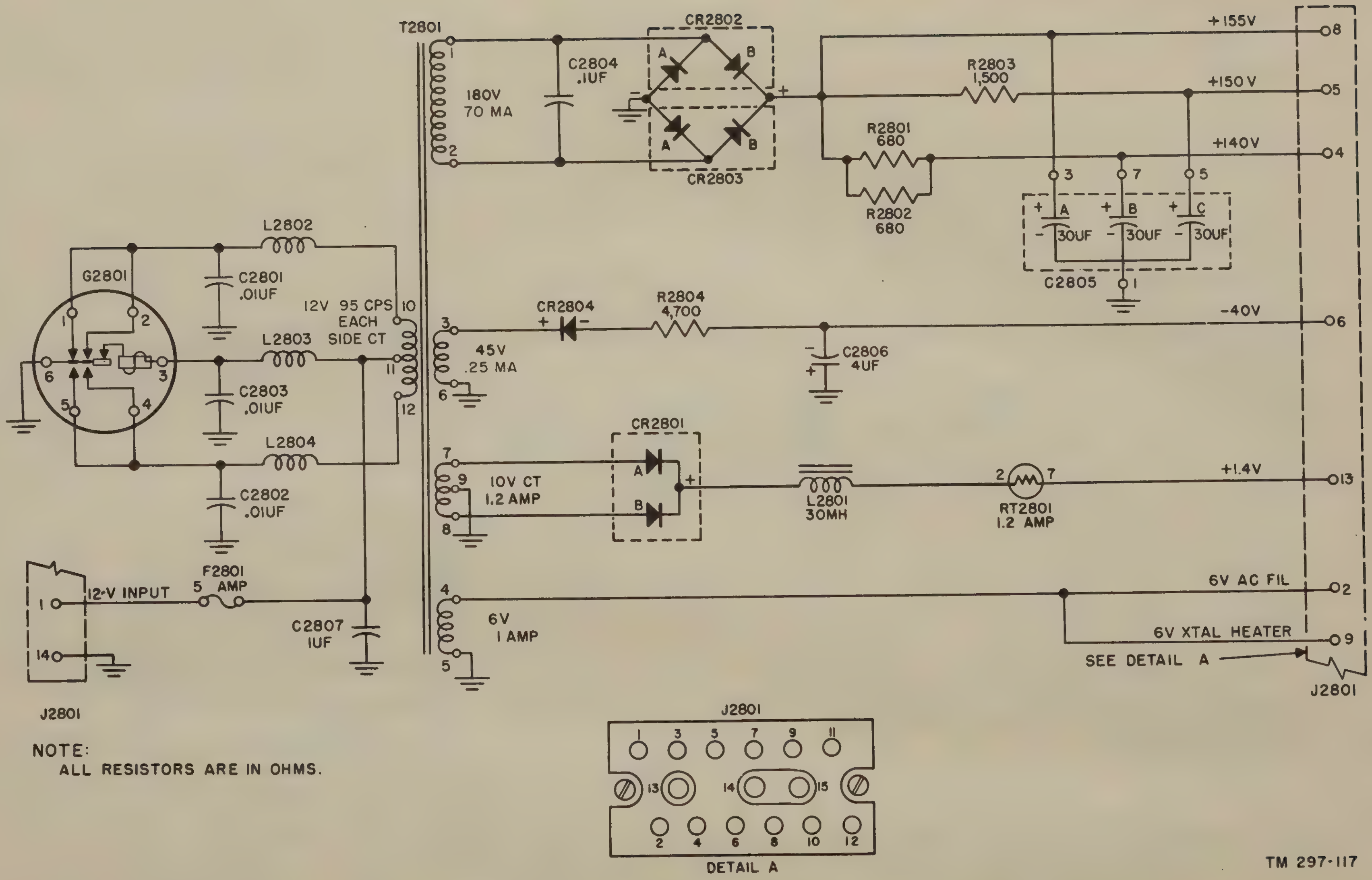
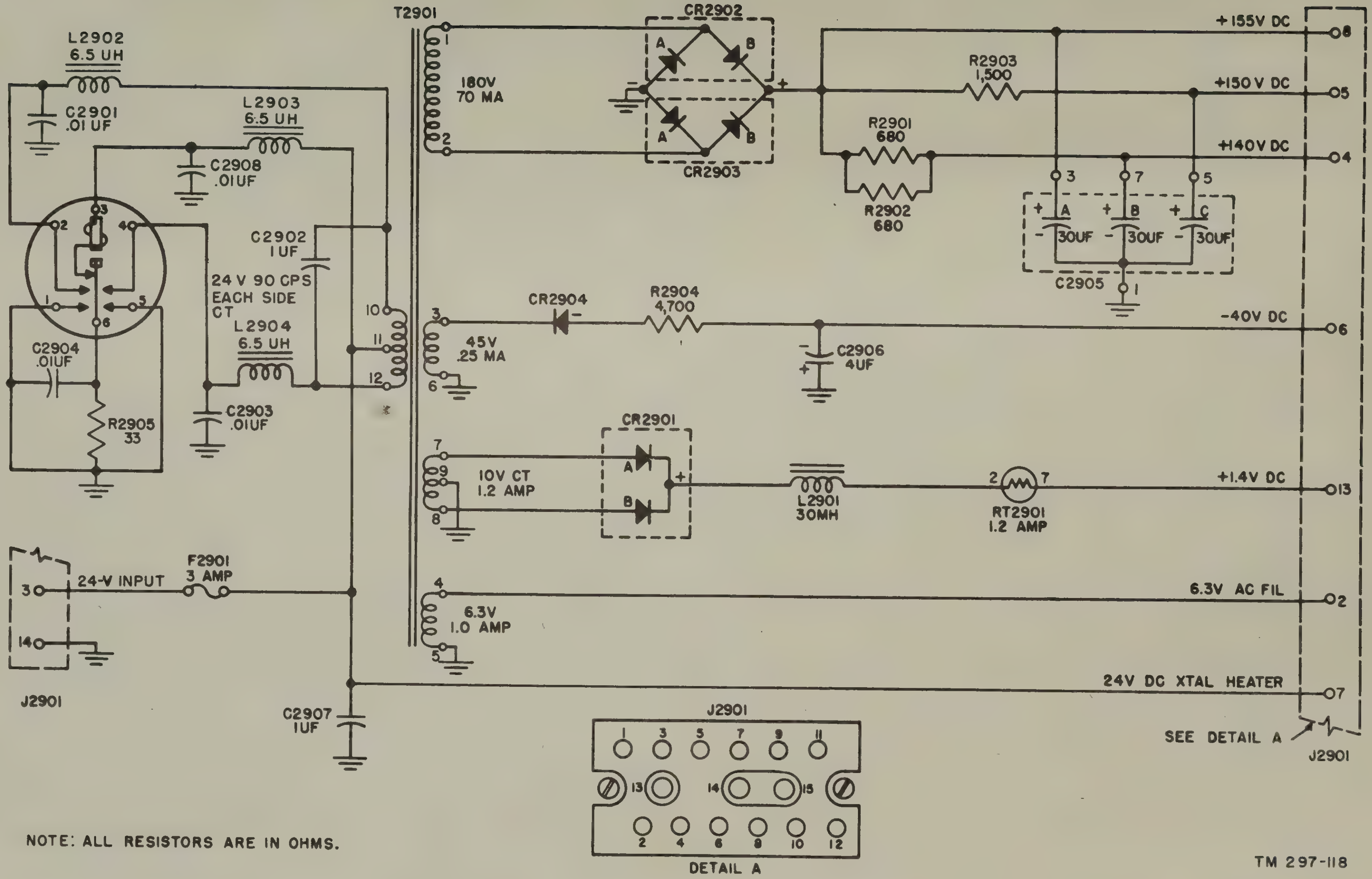


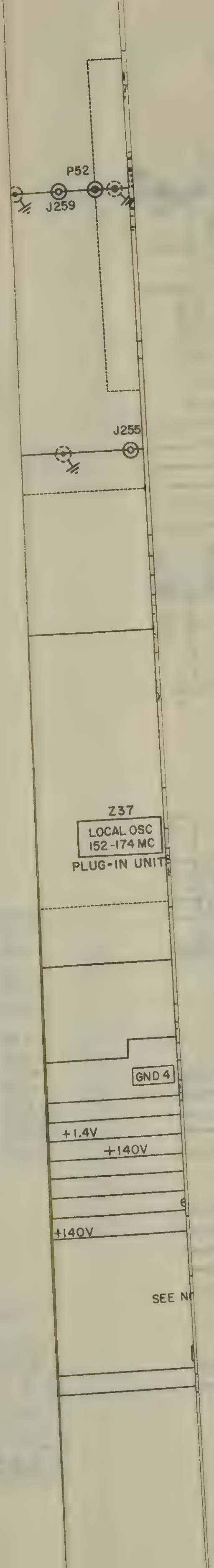
Figure 65. Power supply PP–868/U, schematic diagram.

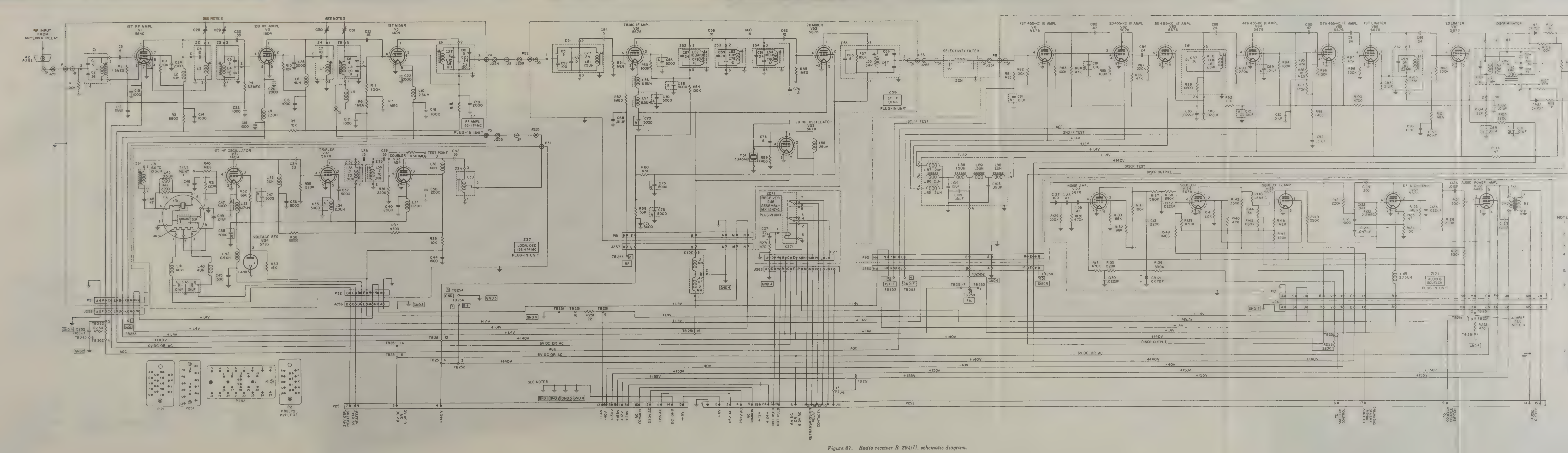


NOTE: ALL RESISTORS ARE IN OHMS.

TM 297-118

Figure 66. Power supply PP–867/U, schematic diagram.


P52
J259
J255
Z37
LOCAL OSC
152-174 MC
PLUG-IN UNIT
GND 4
+1.4V
+140V
6
+140V
SEE N



NOTES
1 UNLESS OTHERWISE SHOWN
RESISTORS ARE IN OHMS.
CAPACITORS ARE IN UUF
2 CAPACITORS C28 THROUGH C31 ARE SMALL BRASS TABS MOUNTED BELOW THE PLUG-IN UNIT CHASSIS
3 CAPACITORS C65, C66, AND C67 HAVE A NEGATIVE TEMPERATURE COEFFICIENT
4 PLACE JUMPER BETWEEN TERMINALS 10 AND 11 OF TB251 WHEN IT IS DESIRABLE TO USE THE RETRANSMISSION RELAY UNIT
5 GND 1, GND 2, GND 3, AND GND 4 SPECIFIC GROUND CONNECTIONS IN RECEIVER BASE
6 THE FOLLOWING DIFFERENCES EXIST ON ALL EQUIPMENTS USING AUDIO & SQUELCH PLUG-IN UNITS SERIAL NUMBERED BELOW 1300
A RESISTOR, R150, IS CONNECTED BETWEEN THE 150-VOLT LINE AND PIN 2 OF V125
THERE IS NO CONNECTION BETWEEN PINS 2 OF V124 AND V125
THE VALUE OF C129 IS 24 UUF
THE VALUE OF R131 IS 1 MEG
THE VALUE OF R132 IS 47K
THE VALUE OF R136 IS 220K
THE VALUE OF R137 IS 470K
THE VALUE OF R142 IS 470K
THE VALUE OF R147 IS 220K
THE VALUE OF R149 IS 470K
7 IN EQUIPMENTS USING 2ND IF DISCR PLUG-IN UNITS BEARING SERIAL NUMBERS 5551 OR HIGHER, FILTER UNIT FL81 IS REPLACED BY INDIVIDUAL CAPACITORS AND A RESISTOR READING FROM LEFT TO RIGHT ON THE SCHEMATIC, C111 (150 UUF), R115 (47K), AND C112 (100 UUF)

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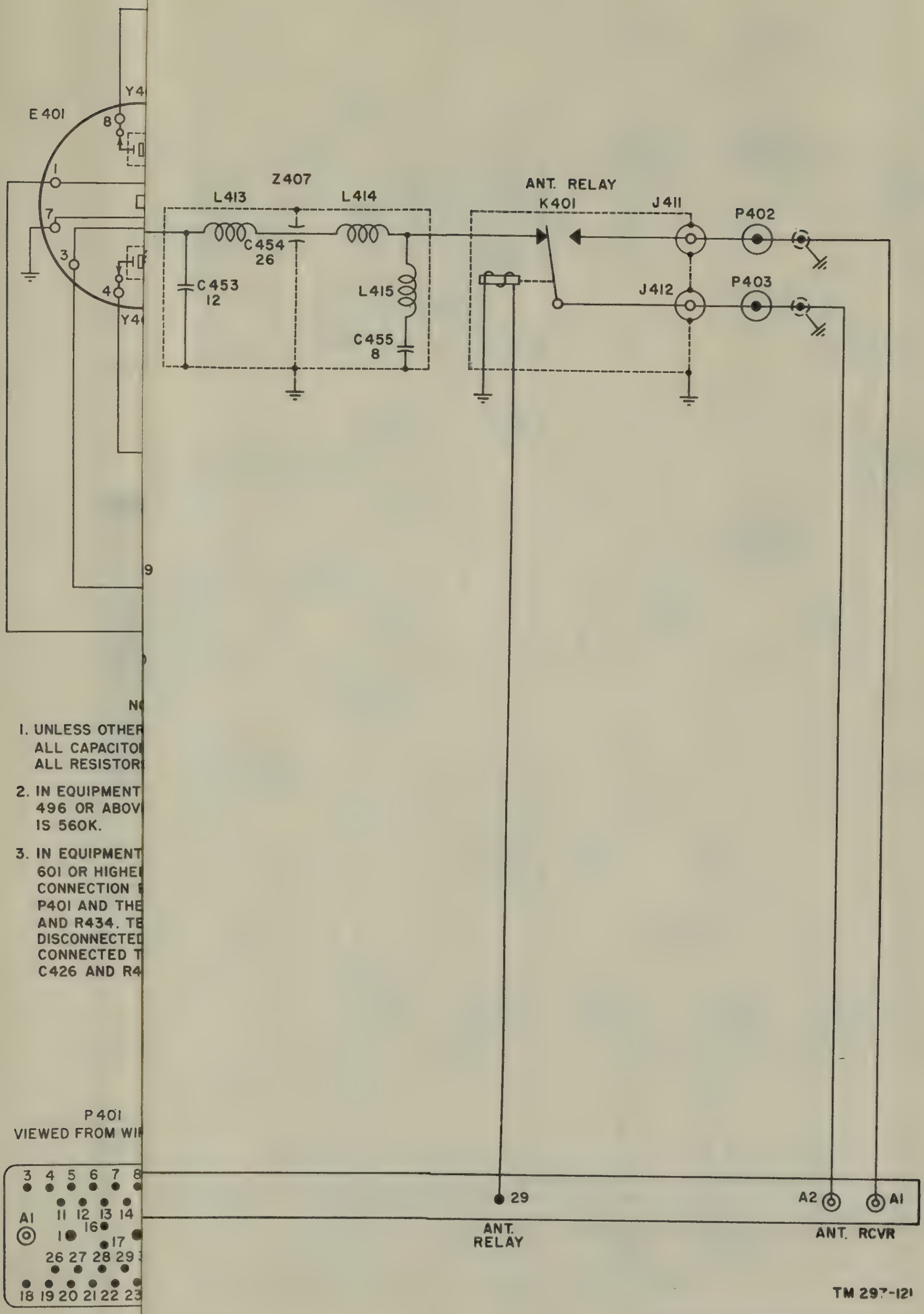
Figure 67. Radio receiver R-394/U, schematic diagram.

305608 O - 54 (Face p. 92) No. .



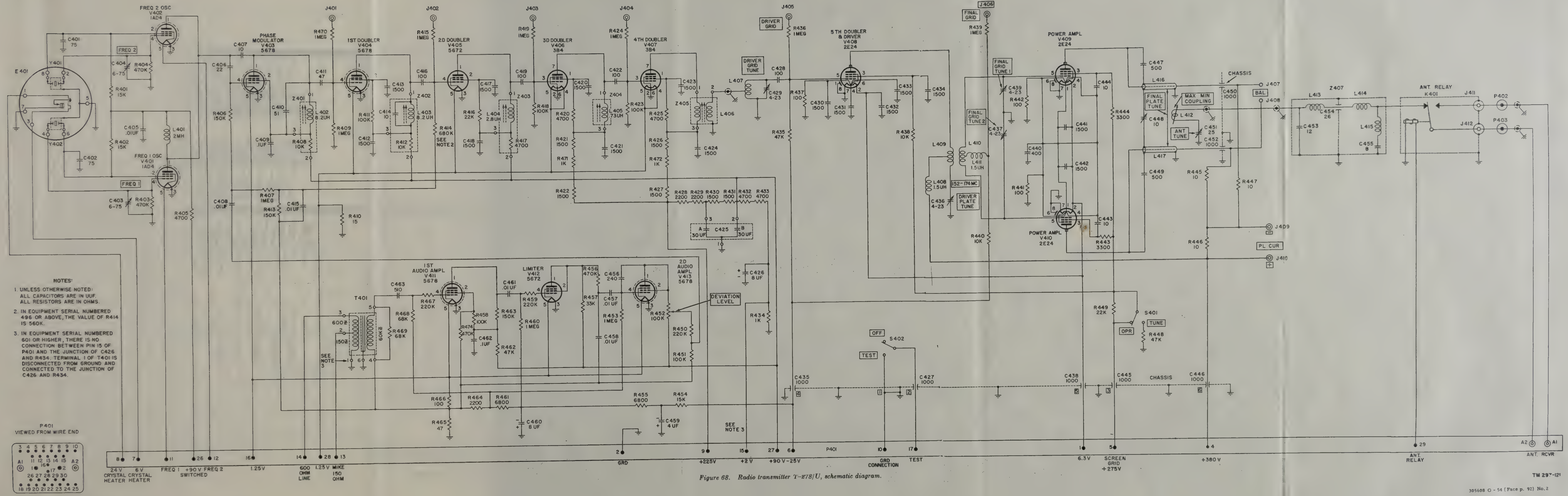
N

1. UNLESS OTHER
ALL CAPACITO
ALL RESISTOR

2. IN EQUIPMENT
496 OR ABOV
IS 560K.

3. IN EQUIPMENT
601 OR HIGHE
CONNECTION
P401 AND THE
AND R434. TE
DISCONNECTED
CONNECTED T
C426 AND R4

305608 O - 54 (Face p. 92) No. 2



NOTES:

1. UNLESS OTHERWISE NOTED:
   ALL CAPACITORS ARE IN UUF.
   ALL RESISTORS ARE IN OHMS.
2. IN EQUIPMENT SERIAL NUMBERED 496 OR ABOVE, THE VALUE OF R414 IS 560K.
3. IN EQUIPMENT SERIAL NUMBERED 601 OR HIGHER, THERE IS NO CONNECTION BETWEEN PIN 15 OF P401 AND THE JUNCTION OF C426 AND R434. TERMINAL 1 OF T401 IS DISCONNECTED FROM GROUND AND CONNECTED TO THE JUNCTION OF C426 AND R434.

Figure 68. Radio transmitter T-278/U, schematic diagram.

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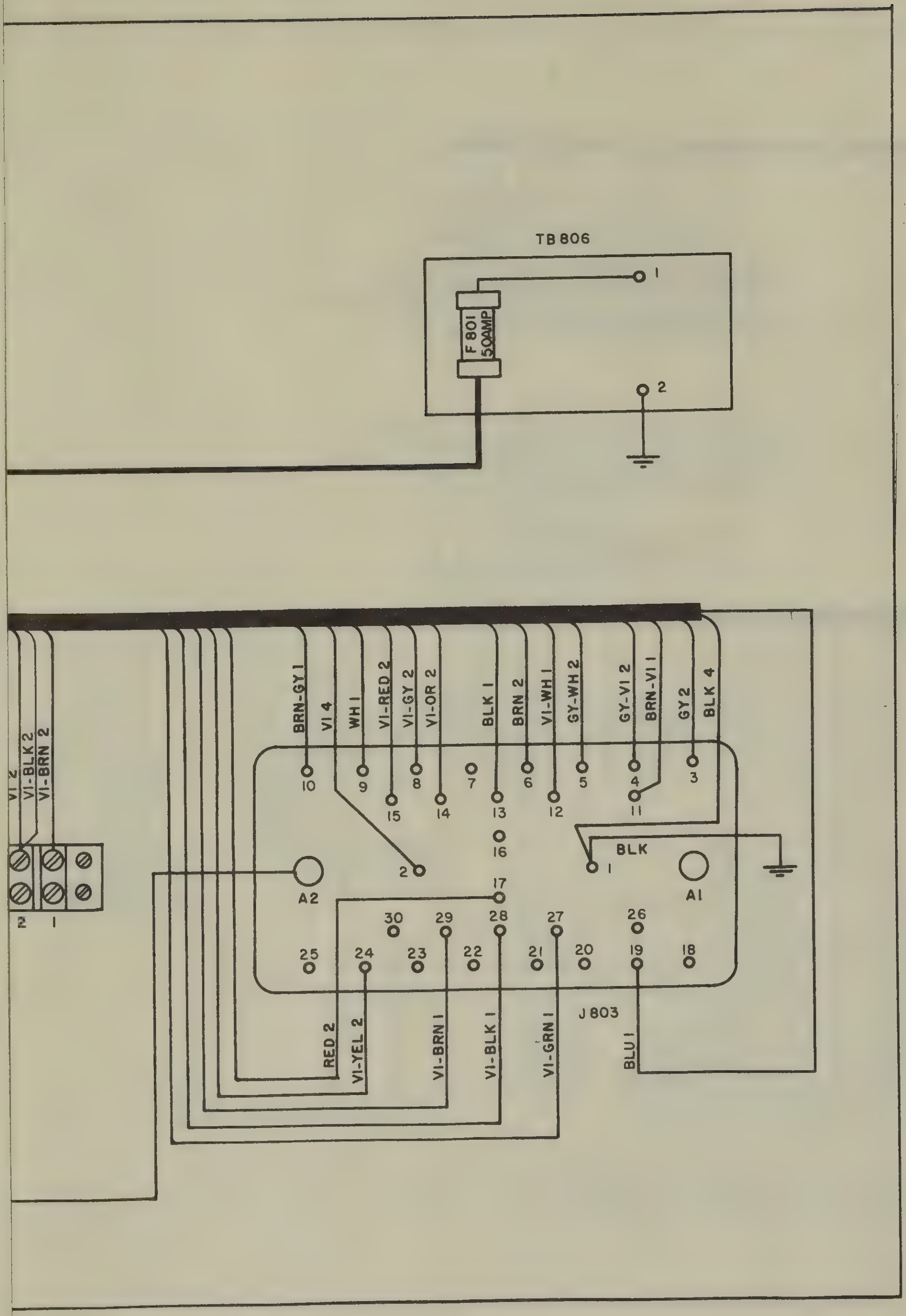
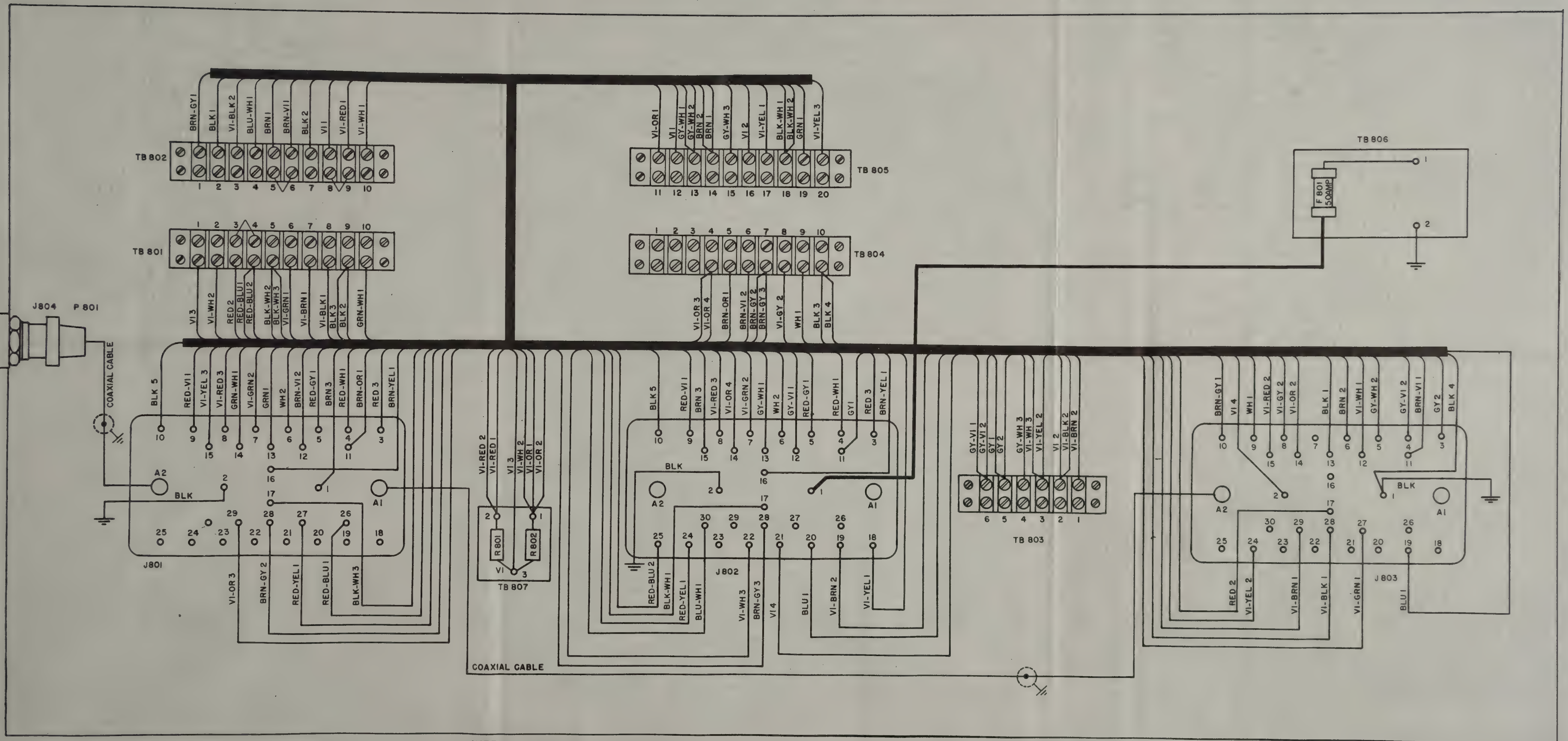
305608 O - 54 (Face p. 92) No. 2



TM 297-122

305608 O - 54 (Face p. 92) No. 3



NOTE:
TO FIND THE OTHER END OF ANY LEAD, LOCATE THE SECOND LEAD BEARING THE SAME COLOR AND NUMBER DESIGNATIONS. THUS THE OTHER END OF THE LEAD CONNECTED TO TERMINAL 1 OF TB 802 (MARKED BRN-GY 1) IS CONNECTED TO PIN 10 OF J803.

Figure 69. Electrical equipment cabinet CY–938(*)/VRC, wiring diagram.

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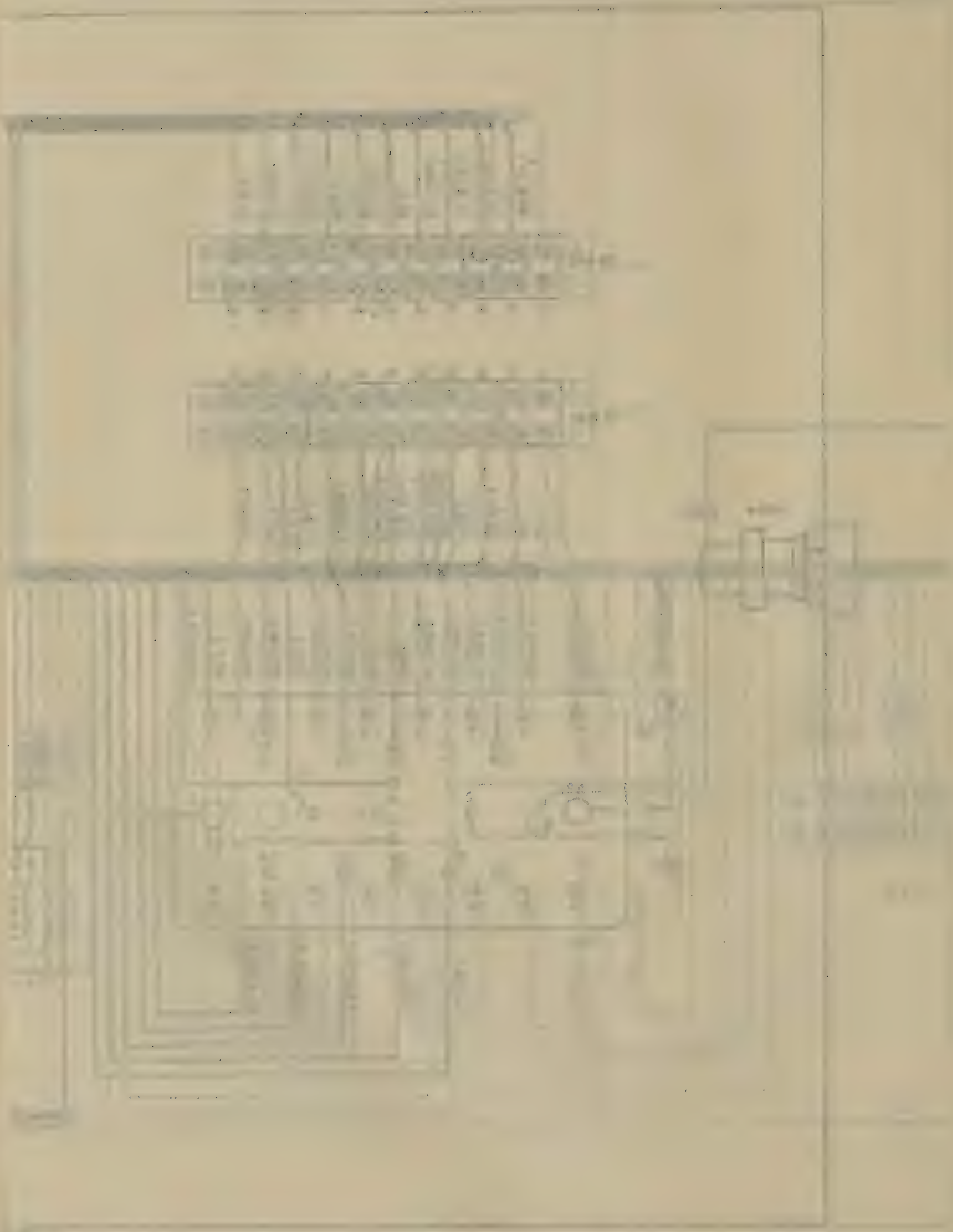
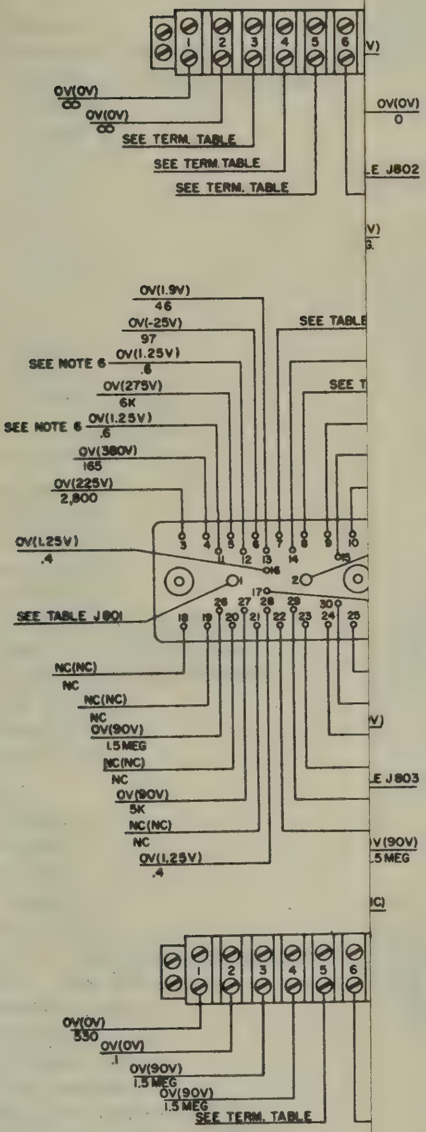
305608 O - 54 (Face p. 92) No. 3



[illegible]

[illegible]



NOTES:

1. FOR 6-, 12-, AND 24-VOLT OPERATION CONNECT JUMPERS BETWEEN THE FOLLOWIN TERMINALS: 3 AND 4 ON TB801; 5 AND 6, AN 8 AND 9 ON TB802.
2. CONNECT JUMPERS BETWEEN TERMINALS 1 A 2 OF TB803 FOR 6-VOLT OPERATION, 3 AND OF TB802 FOR 12-VOLT OPERATION, OR 2 A 3 OF TB803 FOR 24-VOLT OPERATION.
3. ALL MEASUREMENTS MADE WITH THE SPECI JUMPERS CONNECTED, SQUELCH SWITCH IN OFF POSITION, AND RETRANSMISSION RELA (IF ONE IS IN USE) DISCONNECTED. WHEN MAKING RESISTANCE MEASUREMENTS, DISCONNECT THE BATTERY SOURCE AND PLACE THE VOLUME-OFF CONTROL IN THE OFF POSITION.

TERMINAL BOARD	TERMINAL	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
		E1 (VOLTS)	E2 (VOLTS)	R (OHMS)	E1 (VOLTS)	E2 (VOLTS)	R (OHMS)	E1 (VOLTS)	E2 (VOLTS)	R (OHMS)
TB801	5	24	0	17	12	0	17	6	0	17
TB802	3	24	24	∞	12	12	∞	6	6	∞
TB802	4	0	0	∞	12	12	∞	0	0	∞
TB802	5	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
TB802	6	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
TB803	1	0	0	∞	0	0	∞	6	6	∞
TB803	2	24	24	∞	12	12	∞	6	6	∞
TB803	3	24	24	∞	0	0	∞	0	0	∞
TB805	14	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
TB805	16	24	24	∞	12	12	∞	6	6	∞
TB805	17	24	24	∞	12	12	∞	6	6	∞
TB805	18	24	0	17	12	0	17	6	0	17
TB806	1	24	24	∞	12	12	∞	6	6	∞

TERMINAL	J801								
	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)
1	0	6A-C	1	0	6	.5	0	6	.5
7	0	0	7	6	6	7	6	6	7
8	24	24	20	0	0	20	0	0	20
10	0	0	0	0	0	0	0	0	0
17	24	0	17	12	0	17	6	0	17

TERMINAL	J802								
	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)
1	24	24	∞	12	12	∞	6	6	∞
7	0	0	7	6	6	7	6	6	7
8	24	24	20	0	0	20	0	0	20
10	0	0	0	0	0	0	0	0	0
15	0	6A-C	.1	0	6	.5	0	6	.5
17	24	0	17	12	0	17	6	0	17
18	24	24	∞	12	12	∞	6	6	∞
19	0	0	∞	0	0	∞	6	6	12
20	0	0	∞	12	12	10	0	0	∞
21	0	0	∞	0	0	∞	6	6	1.6
22	24	24	∞	0	0	∞	0	0	∞
30	0	0	∞	0	12	22	0	0	∞

TERMINAL	J803								
	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)
2	0	0	∞	0	0	∞	6	6	1.6
6	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
11	6A-C	6A-C	1.7	6A-C	6A-C	1.7	6	6	1.7
19	0	0	∞	12	12	10	0	0	∞
24	24	24	∞	0	0	∞	0	0	∞

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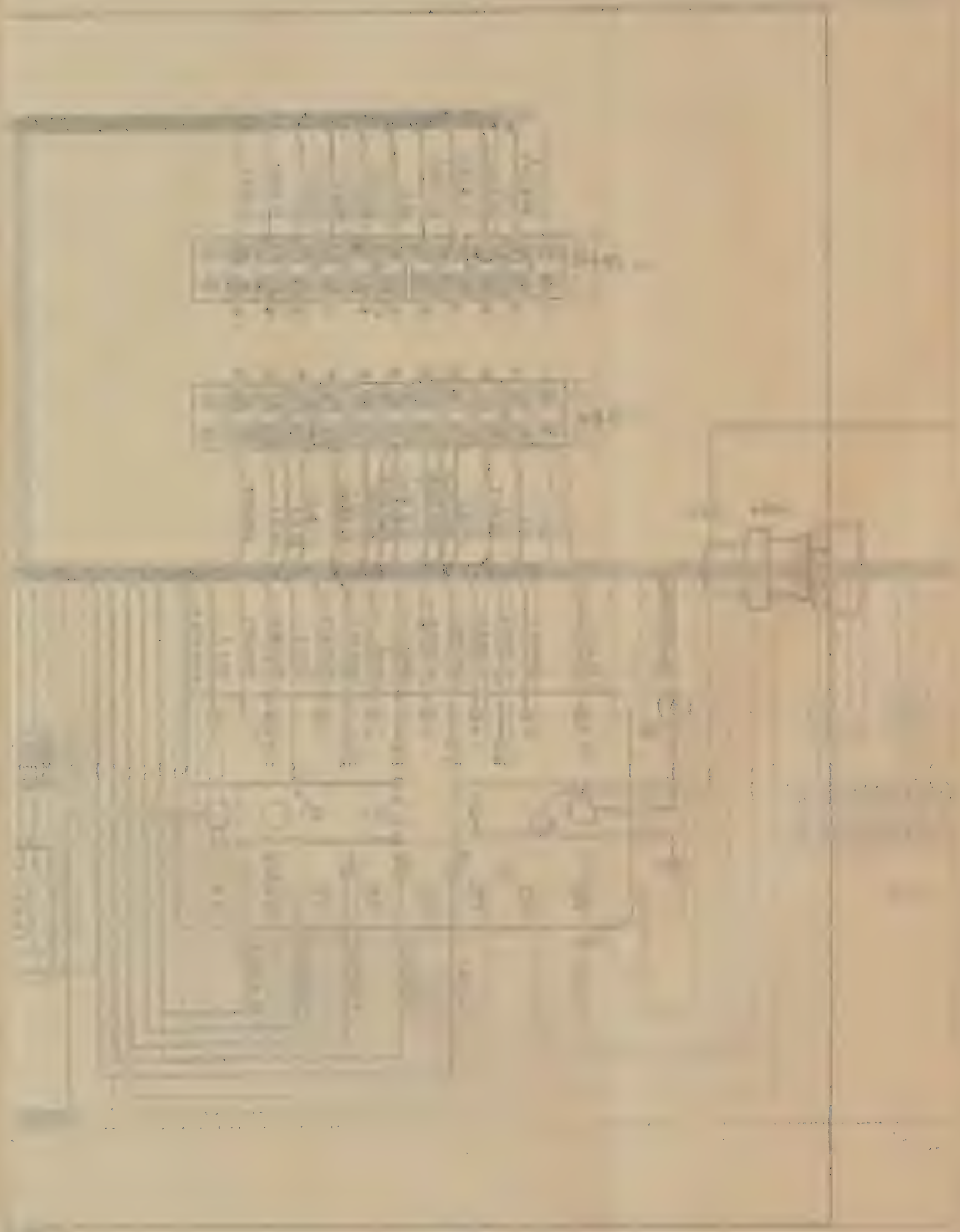

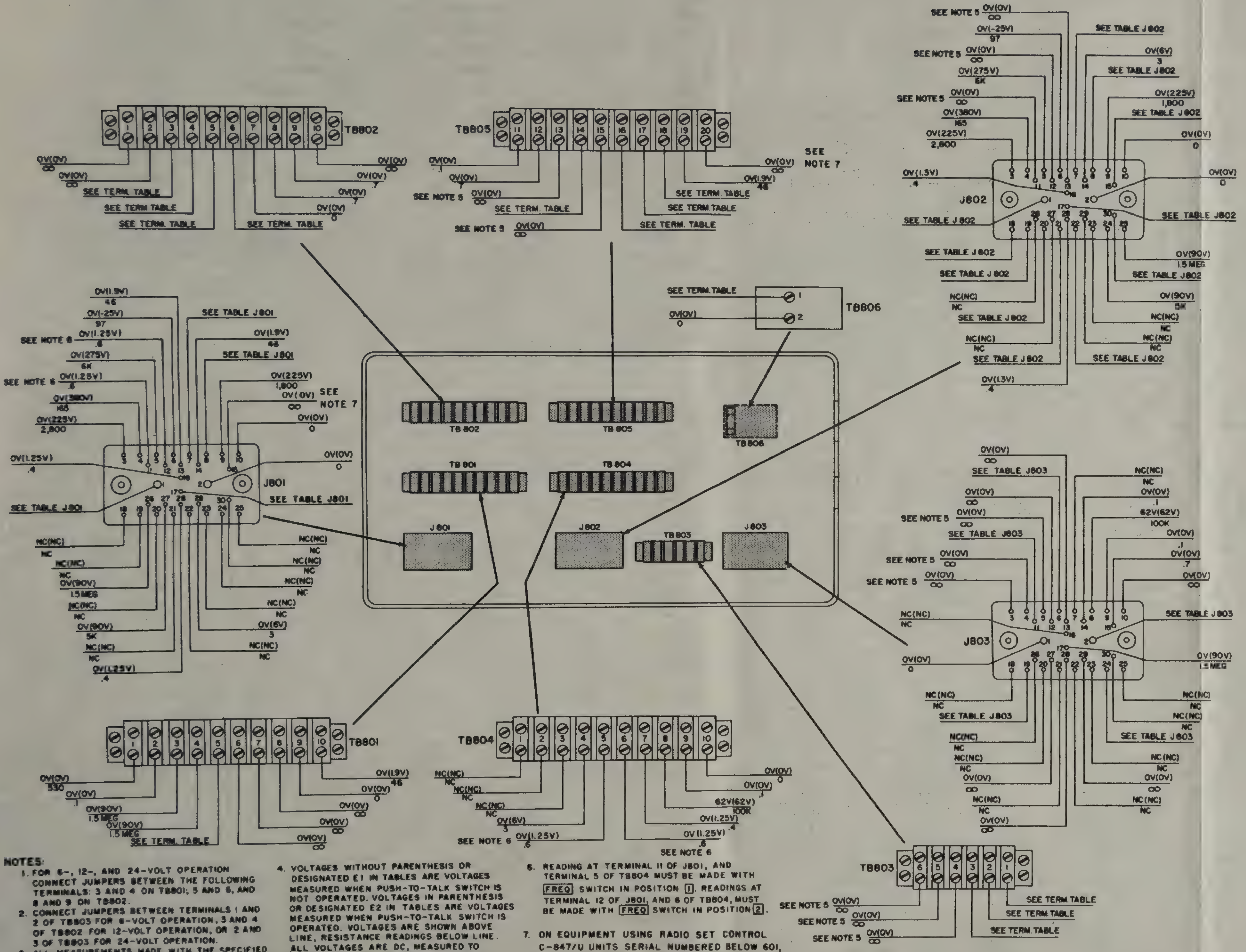

NOTES:

1. FOR 6-, 12-, AND 24-VOLT OPERATION CONNECT JUMPERS BETWEEN THE FOLLOWING TERMINALS: 3 AND 4 ON TB801; 5 AND 6, AND 8 AND 9 ON TB802.
2. CONNECT JUMPERS BETWEEN TERMINALS 1 AND 2 OF TB803 FOR 6-VOLT OPERATION, 3 AND 4 OF TB802 FOR 12-VOLT OPERATION, OR 2 AND 3 OF TB803 FOR 24-VOLT OPERATION.
3. ALL MEASUREMENTS MADE WITH THE SPECIFIED JUMPERS CONNECTED, SQUELCH SWITCH IN OFF POSITION, AND RETRANSMISSION RELAY (IF ONE IS IN USE) DISCONNECTED. WHEN MAKING RESISTANCE MEASUREMENTS, DISCONNECT THE BATTERY SOURCE AND PLACE THE VOLUME-OFF CONTROL IN THE OFF POSITION.
4. VOLTAGES WITHOUT PARENTHESIS OR DESIGNATED E1 IN TABLES ARE VOLTAGES MEASURED WHEN PUSH-TO-TALK SWITCH IS NOT OPERATED. VOLTAGES IN PARENTHESIS OR DESIGNATED E2 IN TABLES ARE VOLTAGES MEASURED WHEN PUSH-TO-TALK SWITCH IS OPERATED. VOLTAGES ARE SHOWN ABOVE LINE, RESISTANCE READINGS BELOW LINE. ALL VOLTAGES ARE DC, MEASURED TO GROUND, UNLESS OTHERWISE SPECIFIED.
5. WHEN ELECTRICAL EQUIPMENT CABINET CY-938(*)/VRC IS USED WITH AC POWERED SETS, 115- OR 230-VOLTS AC IS PRESENT AT THE FOLLOWING TERMINALS:

J802	J803	TB803	TB805
11	3	4	13
12	4	5	15

6. READING AT TERMINAL 11 OF J801, AND TERMINAL 5 OF TB804 MUST BE MADE WITH FREQ SWITCH IN POSITION 1. READINGS AT TERMINAL 12 OF J801, AND 6 OF TB804, MUST BE MADE WITH FREQ SWITCH IN POSITION 2.
7. ON EQUIPMENT USING RADIO SET CONTROL C-847/U UNITS SERIAL NUMBERED BELOW 601, THE 2V MICROPHONE VOLTAGE MAY BE PRESENT AT PIN 15 OF J801 AND TERMINAL 20 OF TB805.

TERMINAL BOARD	TERMINAL	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
		E1 (VOLTS)	E2 (VOLTS)	R (OHMS)	E1 (VOLTS)	E2 (VOLTS)	R (OHMS)	E1 (VOLTS)	E2 (VOLTS)	R (OHMS)
TB801	5	24	0	17	12	0	17	6	0	17
TB802	3	24	24	∞	12	12	∞	6	6	∞
TB802	4	0	0	∞	12	12	∞	0	0	∞
TB802	5	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
TB802	6	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
TB803	1	0	0	∞	0	0	∞	6	6	∞
TB803	2	24	24	∞	12	12	∞	6	6	∞
TB803	3	24	24	∞	0	0	∞	0	0	∞
TB805	14	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
TB805	16	24	24	∞	12	12	∞	6	6	∞
TB805	17	24	24	∞	12	12	∞	6	6	∞
TB805	18	24	0	17	12	0	17	6	0	17
TB806	1	24	24	∞	12	12	∞	6	6	∞

TERMINAL	J801								
	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)
1	0	6A-C	1	0	6	.5	0	6	5
7	0	0	7	6	6	7	6	6	7
8	24	24	20	0	0	20	0	0	20
10	0	0	0	0	0	0	0	0	0
17	24	0	17	12	0	17	6	0	17

TERMINAL	J802								
	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)
1	24	24	∞	12	12	∞	6	6	∞
7	0	0	7	6	6	7	6	6	7
8	24	24	20	0	0	20	0	0	20
10	0	0	0	0	0	0	0	0	0
15	0	6A-C	.1	0	6	.5	0	6	.5
17	24	0	17	12	0	17	6	0	17
18	24	24	∞	12	12	∞	6	6	∞
19	0	0	∞	0	0	∞	6	6	12
20	0	0	∞	12	12	10	0	0	∞
21	0	0	∞	0	0	∞	6	6	1.6
22	24	24	∞	0	0	∞	0	0	∞
30	0	0	∞	0	12	22	0	0	∞

TERMINAL	J803								
	24-VOLT SYSTEM			12-VOLT SYSTEM			6-VOLT SYSTEM		
	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)	E_1 (VOLTS)	E_2 (VOLTS)	R (OHMS)
2	0	0	∞	0	0	∞	6	6	1.6
6	6A-C	6A-C	1.6	6A-C	6A-C	1.6	6	6	1.6
11	6A-C	6A-C	1.7	6A-C	6A-C	1.7	6	6	1.7
19	0	0	∞	12	12	10	0	0	∞
24	24	24	∞	0	0	∞	0	0	∞

Figure 70. Electrical equipment cabinet CY–938(*)/VRC, voltage and resistance diagram.

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